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JANUARY, 1947

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VOL. 33 JANUARY, 1947 No. 1

Original Articles

PRINCIPLES AND MECHANICS OF TREATMENT WITH THE SLIDING TWIN SECTION MECHANISM

C. W. CAREY, D.D.S., PALO ALTO, CALIF.

MEMBERS of the American Association and guests:

I have been asked to present to you my work on the Sliding Twin Section mechanism—the philosophy, technique, and treatment. This work has already been published and probably some of you have read it.* I will not give the paper as it appeared in publication, but I will go over some of the salient points and give you additional material ot bring it up to date.

Some eight or ten years ago, I was present when Dr. Atkinson gave a series of lectures on the osteology of the jaws. He showed slides and specimens of skulls of various ages and stages of development, as well as sections and dissections of this material. I was greatly impressed with it. At this time I was, and had been for some time, pushing teeth with lingual arches and, in other cases, with various bracket attachments on the labial and buccal surfaces, pulling them out in horizontal directions to gain arch form and thus accommodate those teeth that did not have room to take their rightful places in the dental arch.

I cringe when I think of the needless suffering of those little innocents when I pushed anterior teeth apart and pulled the crowded member into the space, of the rotations I accomplished by unnecessary force, of the separators I placed in anterior teeth to create space for band placement, of the too frequent decalcification spots which appeared on the surface of the teeth after band re-

Read before the Forty-Third Annual Meeting of the American Association of Orthodontists, Colorado Springs, Colo., Sept. 30-Oct. 3, 1946.

*Force control in the Movement of Dental Structure, Angle Orthodontist 14: 47-67, 1944.

moval from the long-extended treatment, of the rubber bands I asked and expected my patients to wear for months and even years, connecting the extremity of a poorly prepared anchorage unit to activate movement of a solid mass of material which offered just about as much resistance as the anchorage unit itself. I think of the unnatural appearance of these cases after treatment, which looked good to me then (I was so exalted to be able to move teeth at all), and worse than all these things, to see so many of these trusting patients five years later looking not much better than when I first saw them.

This mass of uncontradictable evidence prepared by Dr. Atkinson started me thinking along different lines of treatment strategy. There is very little true and complete originality in anything that is advanced in science and invention. Each offering in advancement is like putting another stone on the pyramid. Thus, this work is just another branch from a tree of ideas, the trunk and main branches of which are the basic principles which have weathered the storm and are now definitely established. The little branches often wither and die, but the main trunk and branches are not affected unless it be a very devastating affliction.

In introduction, I should like to say that I have worked more or less independently during my sixteen years of practice, and what I have to say is a product of the convictions molded from that experience. I do not pose as a scientist, nor do I have positive proof for my statements. Certain ideas, reactions, and hypotheses become convictions when our daily experience produces a strong feeling of their factual significance. I have tried to use any appliance that I felt might have possibilities in treatment, although the great bulk of the work has been with the edgewise mechanism. I purposely have deviated from the accepted routine and technique, with the hope that I might find some better means for the treatment of malocclusion. I firmly believe that, at the outset, one must learn to be technically skillful with one type of appliance, which in itself will take a number of years, but I do not subscribe to the viewpoint that it is best to learn one accepted technique and stay with it without attempting to vary its application or incorporate innovations when it is evident that the technique is not always capable of producing the desired result. For every individual operation we perform, it is quite possible that there is someone, somewhere, who is doing that same thing a little better. It is axiomatic that, as necessity is the mother of invention, tradition is the enemy.

The technique which I am about to describe was designed to utilize and control the forces which are applied in the mechanics of treatment to the fullest extent. The application and control of force and the biologic and physiologic factors are all of equal importance, and the intelligent manner in which we deal with them will be of vital importance to our successful handling of the case.

The forces used in the treatment of malocclusion should be controlled and directed in such a manner that it will be possible to move the dental tissues with a minimum of discomfort and destruction to their most esthetic and most favorable mechanically functioning positions. To do this, there must be at the outset a definite plan of procedure. The mechanics should be selected so that force

may be exerted and controlled in any direction and should be intelligently managed so that the motion proceeds, whenever possible, in a direction which offers the least mechanical resistance. It should embody a relatively fixed stationary anchorage unit from which to obtain the required power to accelerate the objective unit without serious loss of stability to the emanating force or anchorage body. Care should be taken to remove all forces antagonistic to the required direction of movement. Proper application of these principles will enable us to produce a more perfect result with greater ease and efficiency and less discomfort to the patient, to reduce the treatment time, and to insure a more favorable retention.

There are many appliances now in use which embody these features. The edgewise mechanism possesses the necessary requirements, although it is still far from mechanical perfection. Having used it for fourteen years, I am more familiar and dexterous with its technical use. The employment of the mechanics which I am about to describe may be adapted to other appliances as well.

Many principles have been employed for extending arches or increasing distances between two teeth or groups of teeth. Some of these are the locknut and friction sleeve of the ribbon arch, vertical loops, coiled springs, soldered spurs, ligatures, sliding hooks with extension abutting the molar tube, and many others. When the teeth of one arch are moved distally, there is a definite reciprocal force of the same degree on the anchorage unit to accomplish this movement. Many operators first move the molars distally, and then follow with the other buccal and anterior units. Wherever we are using a continuous unbroken arch, either round, square, or rectangular, to accomplish distal movement, we are working with the brakes on in some part of the arch, or we are getting some undesirable tooth movement in one section to accomplish correct directive force in another. Dr. Spencer Atkinson demonstrated that the teeth in either the mandible or the maxilla must be moved distally without first expanding the arch or moving the lateral segments into the hard layer of bone. Clinically, this important demonstration is definitely substantiated. The attempt to move the lateral segments (molars, premolars, and cuspids) distally in section results in rotation of these sections, the molars moving lingually and the cuspids moving buccally, both against dense bone. This reaction has been rectified by using a lingual arch in conjunction, and is an excellent means of distal movement without disturbing the anterior teeth, but lacks positive control of directive force. The lingual arch must be adjusted to the increasing width of the arch as it progresses distally, or the posterior teeth will engage the dense bone area. Some operators use a continuous arch of predetermined ideal form which, when applied, starts expansion immediately and puts the brakes on; others make the first arch narrower and of smaller gauge in an attempt to overcome this resistance. It is of increasing importance that we move these teeth distally with as much freedom as possible, because we have been indelibly impressed with the fact that unless we can move the teeth of both dental arches to their most advantageous mechanical and esthetic position in the jaws, we will not be successful in our treatment. The same thing is applied to arch units when blocked-out cuspids or premolars must be placed in alignment. Generally, the forces used to create

the space and extend the arch segments incorporate antagonistic elements which result in inefficiency, tooth movement not indicated, unwarranted strain on the teeth adjacent to the required space, and damage to the tissues. (I refer to the use of vertical loops, spurs and ligatures, springs, and a various assortment of mechanical armamentarium.)

In the treatment of cases requiring distal movement of the maxillary teeth, after the mandibular stabilized anchorage unit has been set up, it is common practice to incorporate tip-back bends with a rectangular arch wire in all the maxillary bracket areas, including lingual tip-backs of the same degree in the incisal region. This results in tooth movement not indicated in the anterior region, which must later be removed.

I refer to the labial root and lingual crown movement which will accompany the operation. With any rectangular or square arch wire seated in the brackets of the teeth compressing the lateral segments, there is certain to be present some torque force which will impede the distal movement, because, if any torque force is present, the motion is proceeding in two directions at right angles to each other. The use of a small round wire applied in the same manner is far better to effect this motion, but it has its disadvantages in that the tip-back bends when seated in the brackets tend to roll the crowns of the teeth buccally, the action increasing progressively from cuspids to molars.

Distal movement of the teeth will be most successfully accomplished by reducing to the barest minimum any degree of torque or apical root movement in the dental arch receiving the acceleration. Axial positioning of the teeth should take place after the distal crown movement has been accomplished. To attempt to synchronize the two will result in unwarranted strain on the anchorage unit. To state it specifically, the force exerted by No. 6 elastic bands would have to be continued two or three times as long to effect the desired distal positioning. We use as much torque as we can safely incorporate in our anchorage unit to prevent motion. We should then eliminate it from the unit we desire to put in motion. To carry this principle further, we can apply it to the treatment of double protrusion cases. To move the lower teeth distally, we stabilize the upper arch, using stationary anchorage, and remove all torque from the lower arch and move these teeth distally. If this is done efficiently and with all antagonistic forces removed, it can be accomplished in such a short time that there will be very little mesial motion of the maxillary unit, even without the aid of occipital anchorage, because the lowers will move distally much faster than the uppers will move mesially. By reversing this process and applying the brakes (i.e., stationary anchorage to the lower arch), the maxillary teeth are put in freewheeling and move distally. In this way, both arches can be made to occupy distal position without the aid of occipital anchorage.

To attempt this accomplishment, I have for the past eight years used a simple mechanism which has helped me in these objectives. It is called a "sliding twin section." It is shown in Fig. 1 and will not be described in this paper. To adapt this mechanism to the dental arch, the twin wire section is formed to the approximate contour of the arch. Buccal surface bands, occlusal curve bands, and slight tip-back bends, if desired, are made in the side sections.

The side sections are then seated in the edgewise brackets and tied in, with the hooks just mesial to the cuspid brackets. The procedure in treatment will be best illustrated by a description of the plan to be followed in a Class I case, in which the teeth of both arches have drifted mesially, crowding the anterior teeth. In these cases, the teeth of both arches must be carried distally before the final adjustment of arch relationship is established.

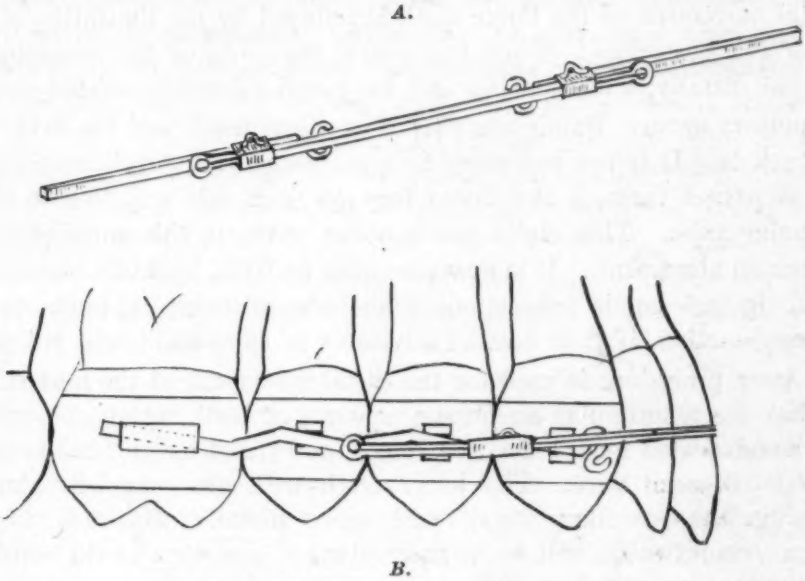

Fig. 1.—*A*, Sliding twin section arch. *B*, Applied to maxillary arch.

Bands are placed on all the teeth except the central and lateral incisors. These teeth are not banded until the distal movement of the lateral segments (cuspids, premolars, and molars) has been completed. The second molars, if erupted, are rarely banded. An arch of 0.018 round stainless steel is applied to the lower arch and tip-back bends are placed in the bracket areas. The maxillary teeth are disturbed as little as possible, and a section of 0.021 by 0.028 arch wire is placed passively in the brackets on each side, with a stop mesial to the molar tube and another distal to the cuspid bracket. An upper impression is taken for the construction of an acrylic palatal stabilizing plate which has an anterior flat plane to occlude with the lower incisors and a hook extension of 0.030 wire on each side, which passes through the first premolar embrasure and engages the mesial of the premolar bracket.

After several weeks it will be time to start distal movement of the lower teeth. The acrylic plate is placed in the upper arch and a twin section arch is adapted to the lower teeth, and Class III intermaxillary rubbers are applied. Tip-back bends are placed in the bracket areas, and the anterior portion of the twin wire is adapted to lie just labial to the anterior teeth. The twin wire is, at this stage, merely a guide wire to keep the lateral segments in the central channel of bone, to prevent immediate expansion of the arch, to resist rotation of the lateral segments, and to enable these segments to receive the full force of the unrestricted power from the rubber elastics.

The distal movement of these teeth should be accomplished in six to eight weeks. When the intermaxillary force is applied, the bone tissue supporting the lower teeth, having been disturbed for several weeks, permits free movement of these teeth; whereas, in the maxillary arch, it will be several weeks before the bone disturbance created by the force of the rubbers will permit extensive tooth movement. The plate acts as an auxiliary support, and cuspal interference with distal movement of the lower teeth is reduced by the limitation of occlusal contact of the posteriors. When the lateral segments of the mandibular arch have moved distally, wide spacing and improved alignment of the central and lateral incisors occur. Bands are placed on these teeth and the arch is seated in the brackets. It is not necessary to remove the arch for this operation. A ligature is passed through the closed loop on each side and tied to the distal of the molar tube. This closes the spacing, retracts the anterior teeth and places them in alignment.. It is now ready for an 0.021 by 0.028 continuous arch wire with tip-back bends for stationary anchorage. Occipital anchorage can be used in conjunction, if it is deemed advisable to have additional support.

The same procedure is used for the distal movement of the maxillary teeth, except that the mandibular anchorage consists of teeth which are well tipped distally, as advocated by Dr. Charles Tweed, and stabilized to some extent by an 0.021 by 0.028 arch wire. The lower teeth will move mesially during this process, but the maxillary teeth will move distally so much faster that the lowers, theoretically, will be in their planned positions at the conclusion of this treatment stage, which should require six to eight weeks.

The upper central and lateral incisors are never banded until the last two months of treatment. At this time they are first retraced by the space-closing operation and then, if further positioning is indicated, bands are placed for final correction in alignment. It is sometimes necessary to place an 0.021 by 0.028 upper arch wire to complete the treatment; but doing so disturbs the incline plane relationship and often necessitates the use of vertical rubbers to correct and balance the errors of cuspal positioning resulting from this rigid control of all the teeth simultaneously. Occasionally, some axial positioning is necessary, but it is surprising how very little torque or root movement is required in the maxilla. The apices of these teeth are all very close to their normal positions, but some buccal root torque in the lateral segments and lingual root torque in the anterior region occasionally are indicated, in order to return these structures toward the positions from which they have moved in the tipping action required in the movement of the crown structure.

To make this correction, the anterior torque section is used (Fig. 2). The anterior portion of the torque section is fitted into the central channel of the brackets of the central and lateral incisors. From the distal of the lateral incisors it bends gingival to the cuspid bracket, and the hook lies 5 mm. gingival to the arch wire between the first and second bicuspid teeth. One of the twin wires will lie in the occlusal and one in the gingival wing of the lateral and central brackets. The hook is then pulled down so that it catches over the arch wire, and it will stay safely in position. This accessory arch will apply torque

to the anterior teeth without disturbing the cuspal interdigitation of the posteriors, which has been established.

By allowing the teeth the freedom to shift for themselves when they are back where they belong, the interdigitation of teeth and incline plane relationship is accomplished with the able assistance of the masticatory mechanism itself. In general, the more freedom we allow the upper anterior teeth in treatment, the more esthetic will be their apppearance in the finished case. Sometimes they need to be depressed and, occasionally, to have their axial position corrected; but in the majority of cases, simple alignment only is indicated.

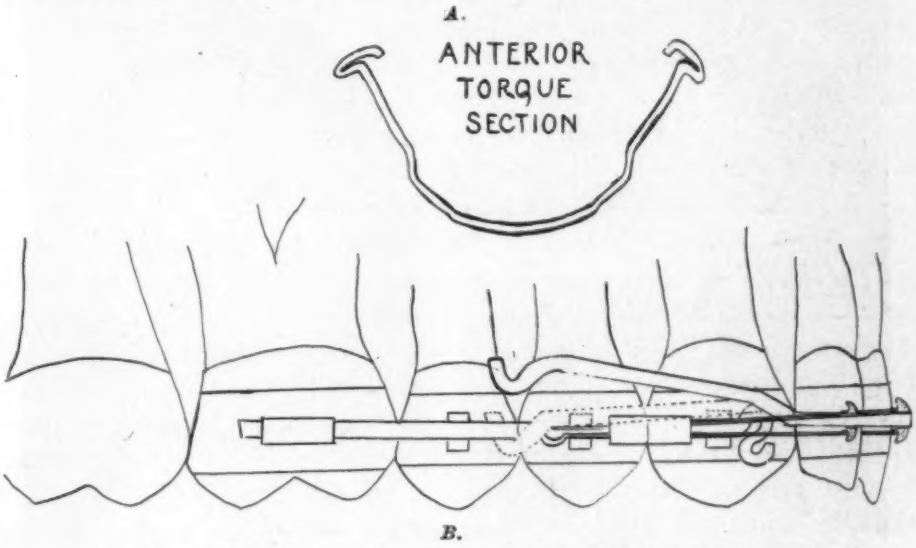

Fig. 2.—*A*, Anterior torque section. *B*, Applied to maxillary arch.

Immediately following active treatment, bands are removed from all teeth except cuspids and the first molars. The twin section arch used in treatment is replaced and adjusted so that the twin wire is in direct contact with all anterior teeth. A silk ligature is tied from the loop in the end of the twin wire to the molar tube on each side (Fig. 3). The patient is instructed to return in one week for removal of the remaining bands. This space-closing operation will move the anterior teeth approximately $\frac{1}{20}$ inch lingually and improve the appearance immensely. It allows settling of the cusps into more favorable incline plane relationship, so that the placement of retaining devices will not serve to hold the teeth in malocclusion to the extent of that which is produced when this operation is eliminated.

Because of the confusion in the minds of those who have attempted this technique following its previous presentation, I will give in detail the steps in the treatment with this mechanism. We will select a case of Class II, Division 1, or Class I malocclusion. In both groups it is necessary to move the dental units of both arches distally in order that, at the conclusion of treatment, the teeth will be favorably located in their respective jaws. Even though the anterior teeth of the lower arch may appear to be in fair alignment and axial position, all of the lower teeth are moved distally, if only to set up a more stable anchorage, to offer greater ease in banding and aligning the anterior teeth, and to facilitate the entire treatment and retention.

Step 1: Separators are placed from distal of cuspid to distal of first molars.

Step 2 (interval of two weeks): Separators are removed and all bands are formed, except central and lateral incisors. Separators are replaced.

Step 3 (interval of one week): Upper molars and first premolars are cemented and separators replaced.

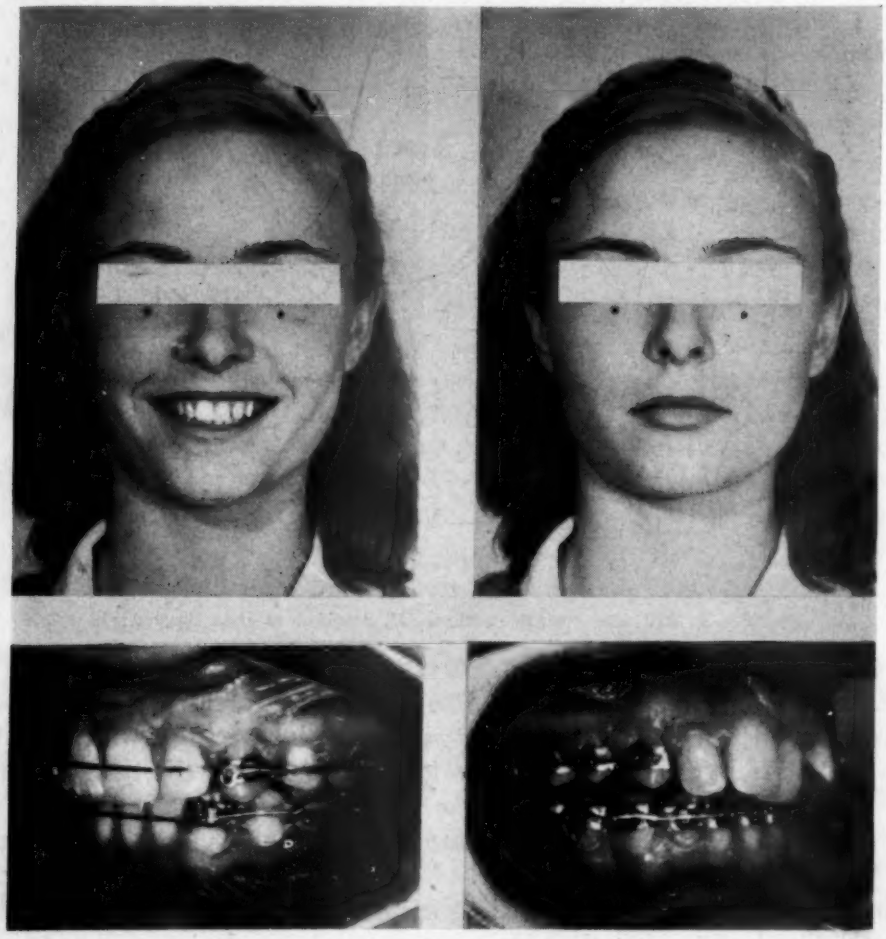

Fig. 3*A*.

Figs. 3*A* and 3*B*.—The space-closing operation near the conclusion of treatment.

Step 4 (interval of one week): Upper cuspids, second premolars, and lower first molars are cemented and 0.018 round arch placed passively on upper arch.

Step 5 (interval of two weeks): Upper arch is removed and side sections of 0.021 by 0.028 from cuspid to molar, and stop distal to cuspid bracket and mesial to molar tube are placed.

Step 6 (interval of two weeks): Upper impression is taken for construction of stabilizing plate.

Step 7 (interval of three days): Place stabilizing plate and cement lower cuspid and second premolar bands. Place 0.018 round lower arch and tie in brackets.

Step 8 (interval of one week): Cement lower first premolar bands and tie in.

Step 9 (interval of one week): Place lower 0.020 arch with slight tip-back bends.

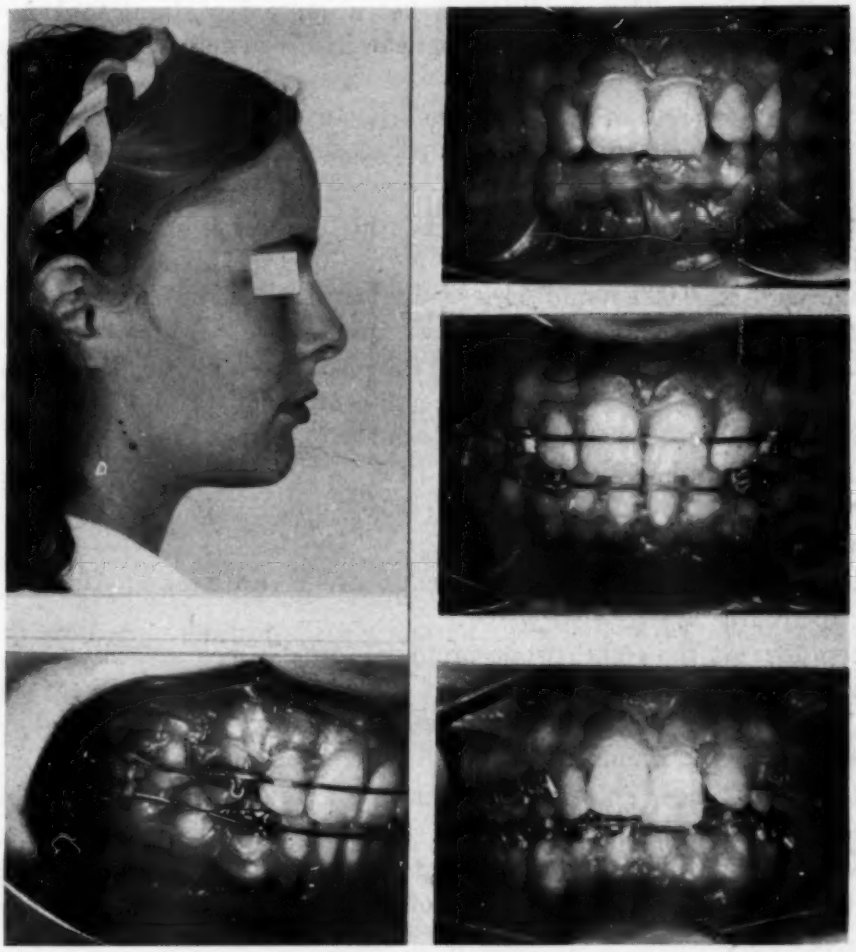

Fig. 3B.—(*For legend, see opposite page.*)

Step 10 (interval of three weeks): Place lower twin section arch with tip-back bends and start Class III anchorage. Instruct patient to wear rubbers constantly, day and night and during meals. The stabilizing plate and rubbers are removed only to brush the teeth.

Step 11: The patient reports for checkup every two weeks and the anterior twin wire is moved forward so that it does not contact the labial surface of the anterior teeth. The fourth week, spaces will appear between the lower anterior teeth regardless of how crowded they were. By the eighth week, or

fourth appointment in this phase, large spaces appear sufficient for complete entrance of a plastic instrument edgewise between each anterior tooth. At this point, the lower anterior bands are formed. Other conditions we expect to see at this stage are: an open-bite and a decidedly distally placed lower jaw, an extreme prominence of the upper anteriors, and the articulation of the mesiobuccal cusp of the upper first molars with the first premolar-second premolar occlusal embrasure, although at no time is there any definite incline plane relationship in occlusion because of the presence of the stabilizing plate which permits only cuspal articulation. This condition is not a cause for alarm so long as the stabilizing plate fits snugly and the patient has been told in advance what to expect.

Step 12: Cement anterior bands and tie twin wire into bracket channel.

Step 13 (interval of one week): Tie back twin wire to molar tubes with grass line.

Step 14 (interval of one week): By this time most of the anterior alignment has been self-corrective. Minor corrections for alignment and rotation are made with an 0.020 round wire section set in the occlusal wing of brackets and tied in.

Step 15 (interval of two weeks): Stop rubbers. Remove lower twin section appliance and place previously cut and contoured 0.021 by 0.028 lower arch with tip-back bends. Substitute 0.022 round wire for rotation section; tie in and discard stabilizing plate.

Step 16 (interval of three weeks): Place upper twin section with tip-back bends and start Class II rubbers.

Step 17: Patient reports for checkup every two weeks. Anterior spaces appear the fourth week.

Step 18: At the eighth week, or fourth appointment, of this phase of the treatment, the spaces allow insertion of a plastic instrument. There should be 2 mm. spaces distal to the lateral incisors, improved alignment, and partially corrected rotations. Bands are formed for the anteriors.

Step 19: Cement anterior bands and tie twin arch in channel of brackets.

Step 20 (interval of one week): Remove the upper arch, contour the twin wire for central and lateral incisors, and replace. Tie-in and tie-back for space closure with grass line to distal of molar tubes. Insert anterior rotation section of 0.020 round.

Step 21 (interval of two weeks): Tie back again with grass line, and replace anterior rotation section with 0.022 round.

Step 22 (interval of two weeks): Spaces should now be closed and normal interdigitation of the teeth complete. Discontinue rubber bands.

(Step 23 [interval of two weeks]: If crowns of anterior teeth appear to be lingually inclined, place anterior torque section, tie in and tie back, and continue rubber bands. In this instance treatment is extended one month.)

Step 24 (interval of two weeks): Correct minor deviations. Removal of upper arch is unnecessary.

Step 25: Remove arches. Remove upper and lower premolar bands and

anterior bands and replace both upper and lower twin sections after exaggerated contouring in cuspid areas because of the presence of brackets on these teeth. Tie back with grass line.

Step 26 (interval of ten days): Remove all remaining bands (cuspids and molars); clean teeth; grind and polish for cuspal excess; and take impressions for retention devices.

Cases in other classifications are treated in a similar manner, but will not be discussed here.

In order that treatment time will be reduced to the shortest duration, a case should not be started in the secondary dentition until complete eruption of the cuspids and premolars has occurred. Banding of teeth before these members have erupted simply extends the time that these bands must remain on the teeth, thus increasing the possibilities of damage to both hard and soft tissues. Treatment should be delayed until the full amount of mechanical advantage is available. Waiting for teeth to erupt with bands placed, before commencing the next treatment stage, is inexcusable and gains nothing. There seems to be too great a tendency to justify early band placement by flimsy predications, when the underlying reason is too often the desire to tie up a desirable case. I have seen dozens of transfer cases with full appliance placed on patients at the dental age of 10, in which the molars and anteriors bear bands, the arches are in place with the long span between molars and anteriors, while the so-called treatment progresses, waiting for the eruption of the premolars and cuspids. A full year of appliance wearing, but not treatment, is forced upon the child; an additional expense is borne by the parents; anchorage is lost by mesial drag on the mandibular dental units when rubbers are used at this stage; and when there is the slighest susceptibility to decalcification, there will be damage to the cervical enamel tissue. A result is obtained which is not as good or as stable as that which could be produced in less than half the time had the orthodontist waited for the full complement of teeth to erupt in order to take advantage of the mechanical possibilities which the full dentition affords.

This is only my viewpoint, but I feel so strongly about it that I believe it should not only be mentioned, but strongly stressed. I should like to see just one case out of hundreds that are treated at this stage that was benefited in the slightest degree. It is sometimes indicated to place a lingual arch type of appliance, to be used as a space maintainer, to allow for the eruption of premolars and cuspids; but that is the limit to which any form of treatment is advantageous at this stage. Several years earlier, before the roots of the deciduous molars have resorbed, it is certainly indicated to treat anterior and posterior cross-bites and extreme Class II and Class III malocclusions in which there is a definite jaw deformity; but I see no justification for keeping a child under continuous treatment from the age of 7 until the permanent dentition is complete at 12 years.

We routinely move the mandibular teeth distally in nearly all cases, if for no other reasons than that it affords easier alignment of the anterior teeth and certainly seems to create more favorable retention following treatment. The teeth are easily banded, and separators are never placed anterior to the cus-

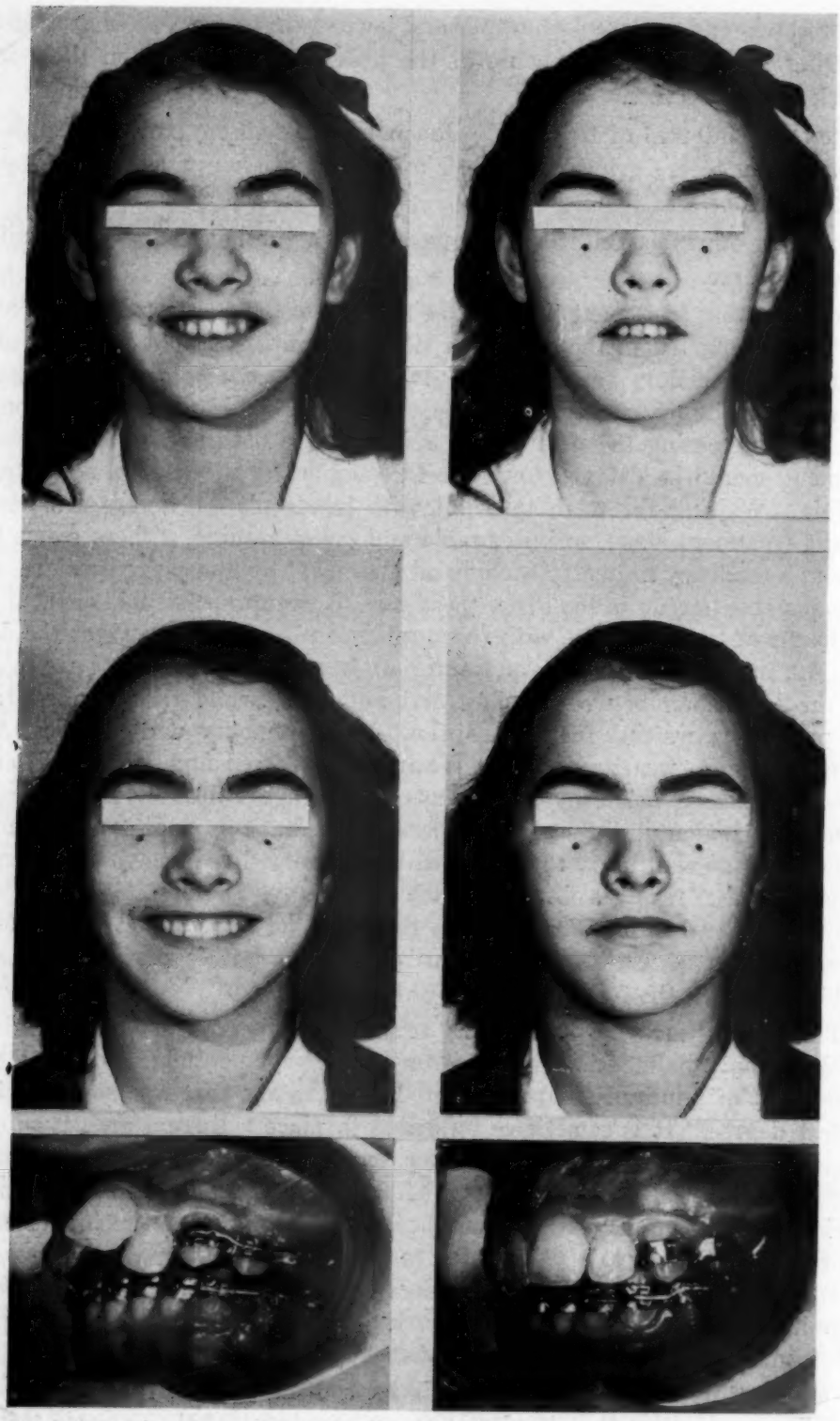

Fig. 4A.

Figs. 4A and 4B.—Treatment stages in Class I malocclusion.

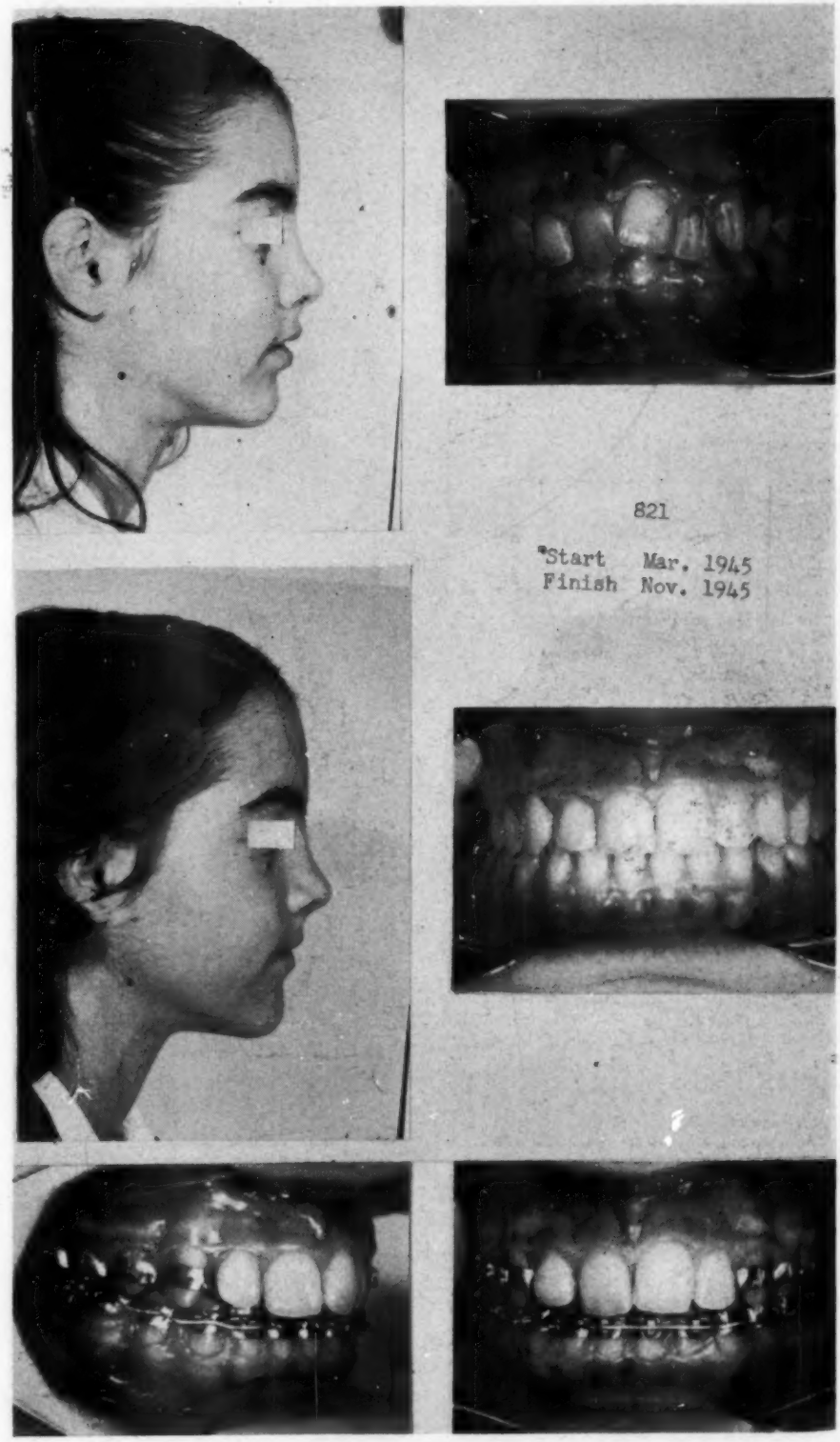

Fig. 4*B*. *(For legend, see opposite page.)*

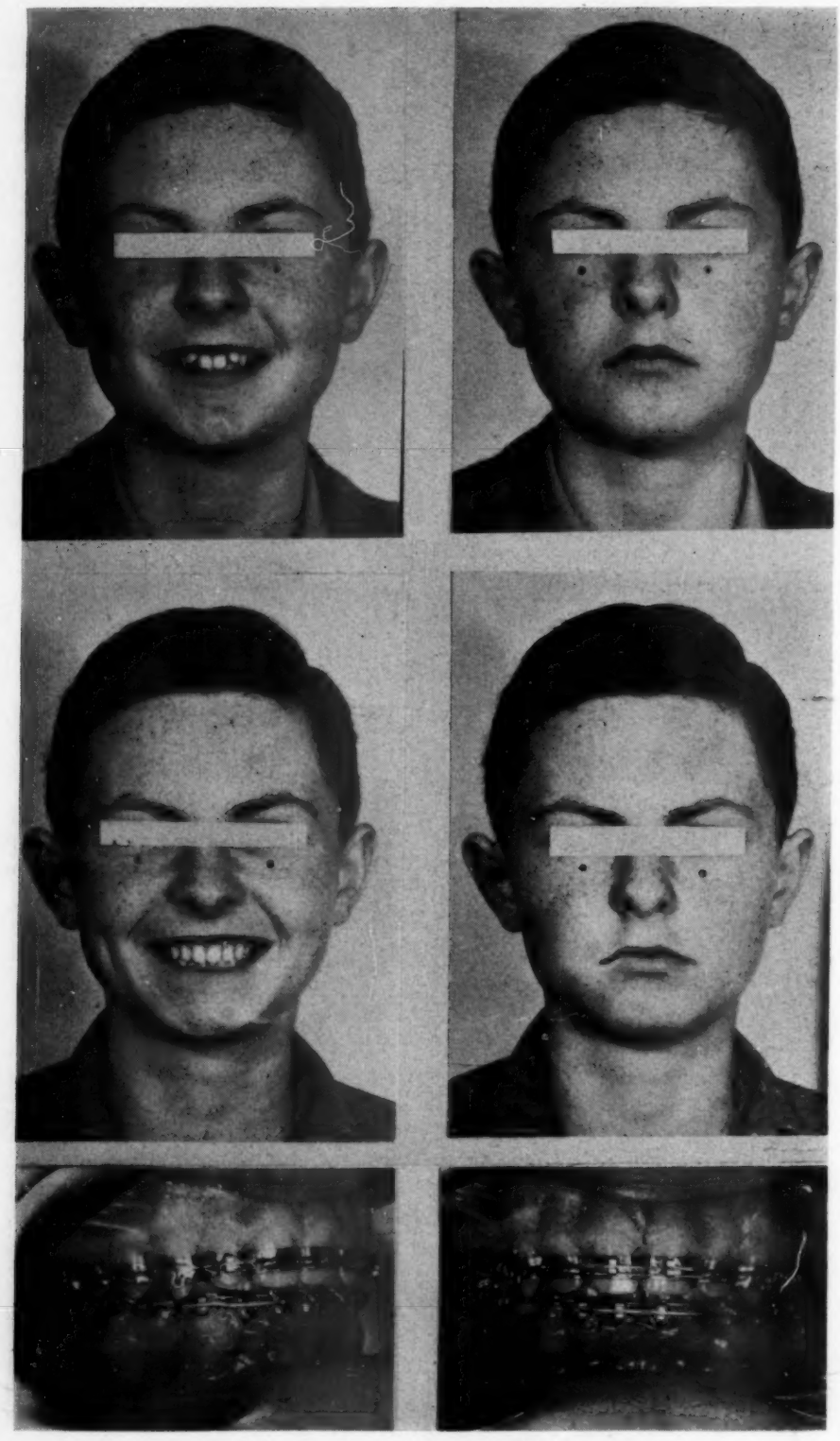

Fig. 5A.

Figs. 5*A* and 5*B*.—Appliance at conclusion of Class II, Division 2 case.

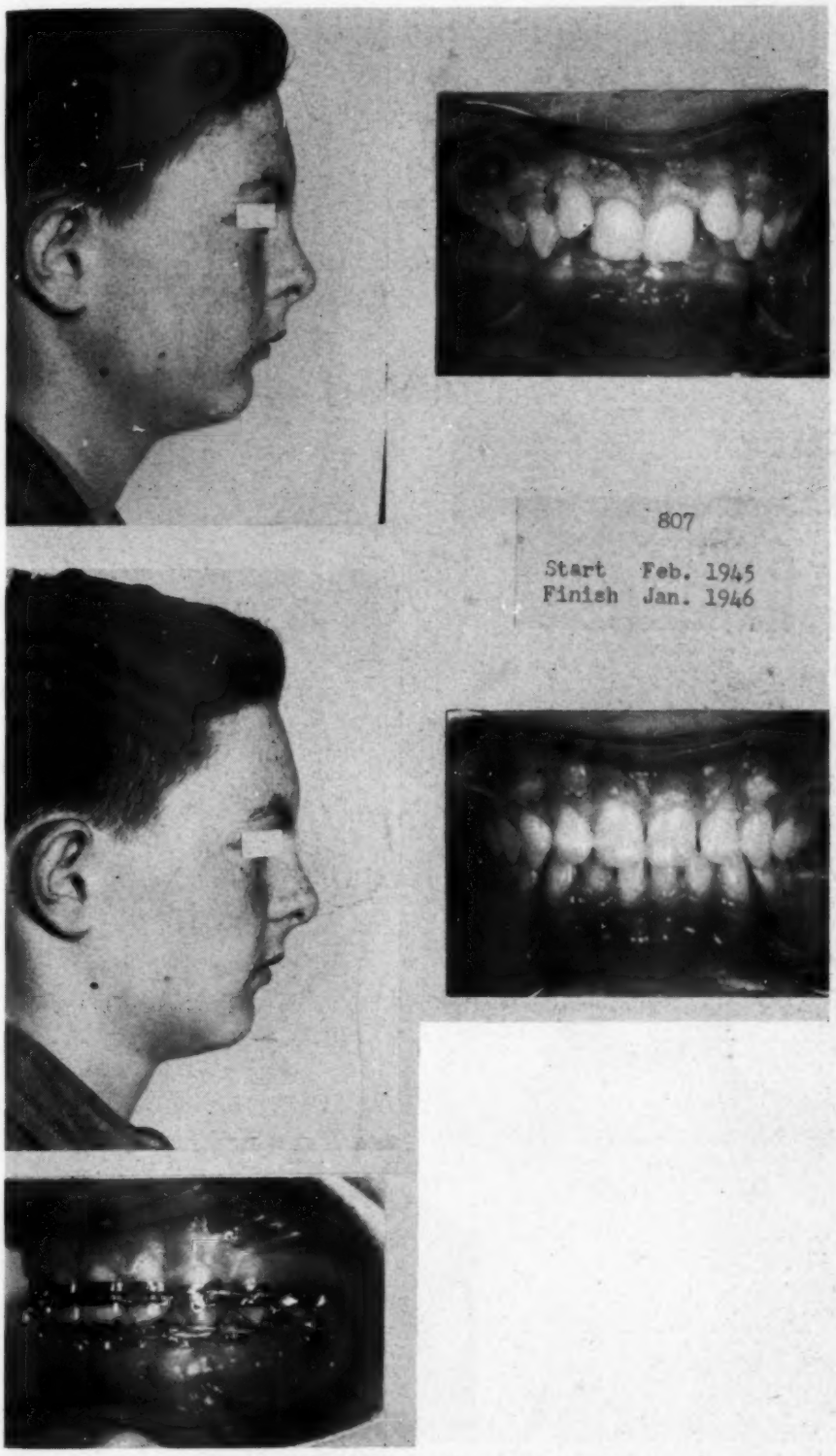

Fig. 5B. *(For legend, see opposite page.)*

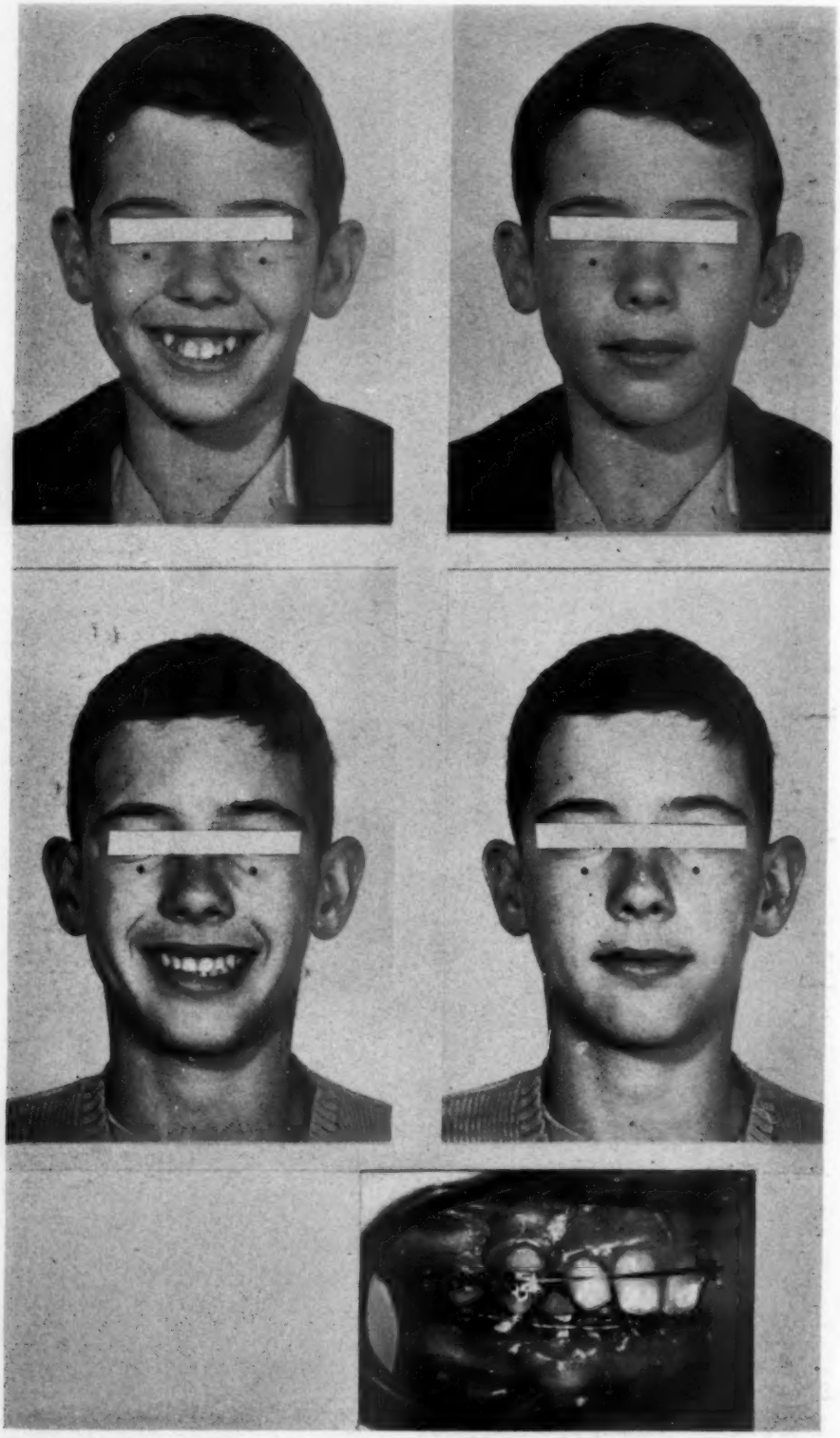

Fig. 6A.

Figs. 6*A* and 6*B*.—Treatment stages in maxillary and mandibular dental protraction in which the first premolars were removed.

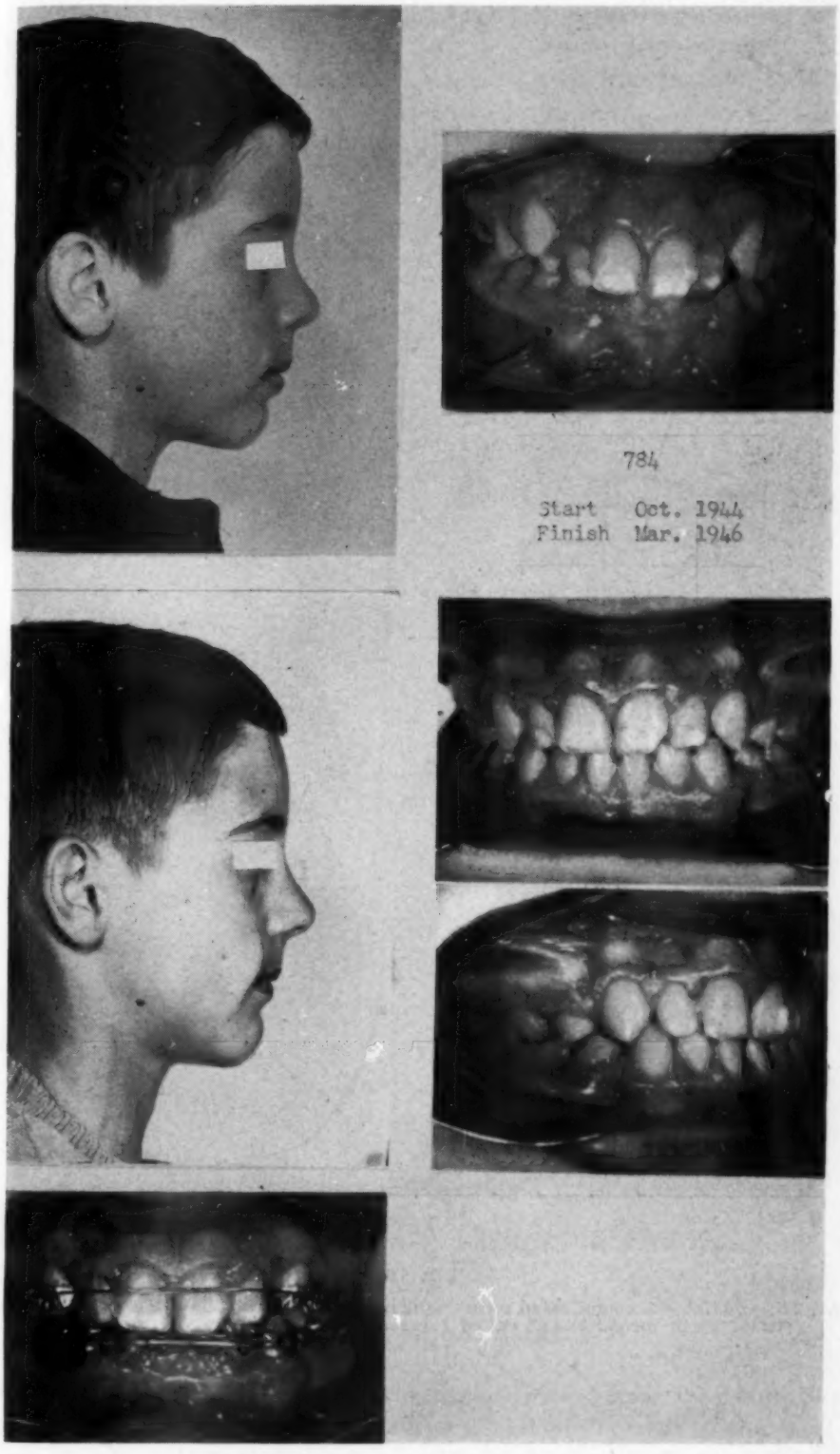

Fig. 6*B*. (*For legend, see opposite page.*)

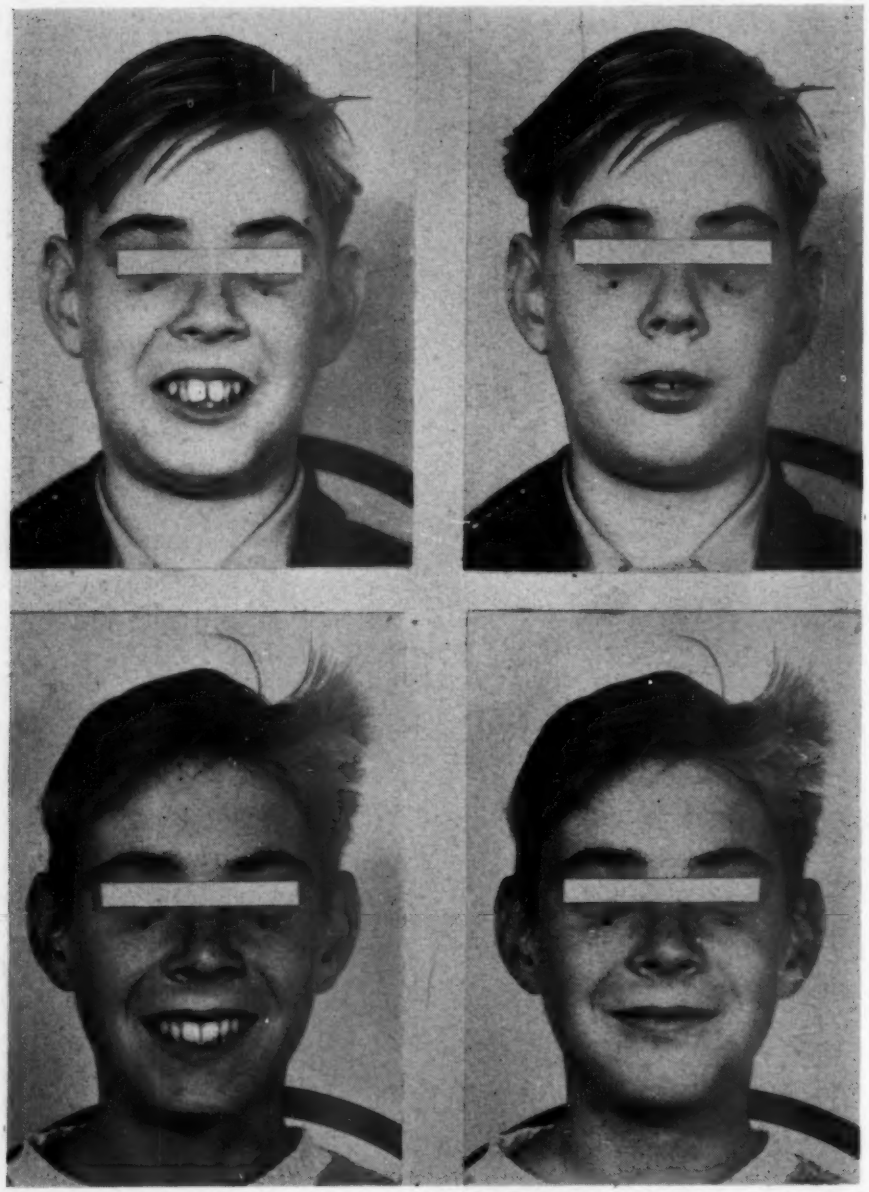

Fig. 7A.

Figs. 7A, 7B, and 7C.—A complicated case requiring thirteen months of active treatment. Anterior tooth measurement called for removal of a lower central incisor.

pid. It actually requires six months to accomplish the distal positioning, alignment, and stabilization of the lower arch. When we have attained this, however, there is very little treatment left, no matter in what position the maxillary teeth may be. Between three and six months is all that is required to move these teeth distally a full cusp or more distance, correct anterior alignment and axial

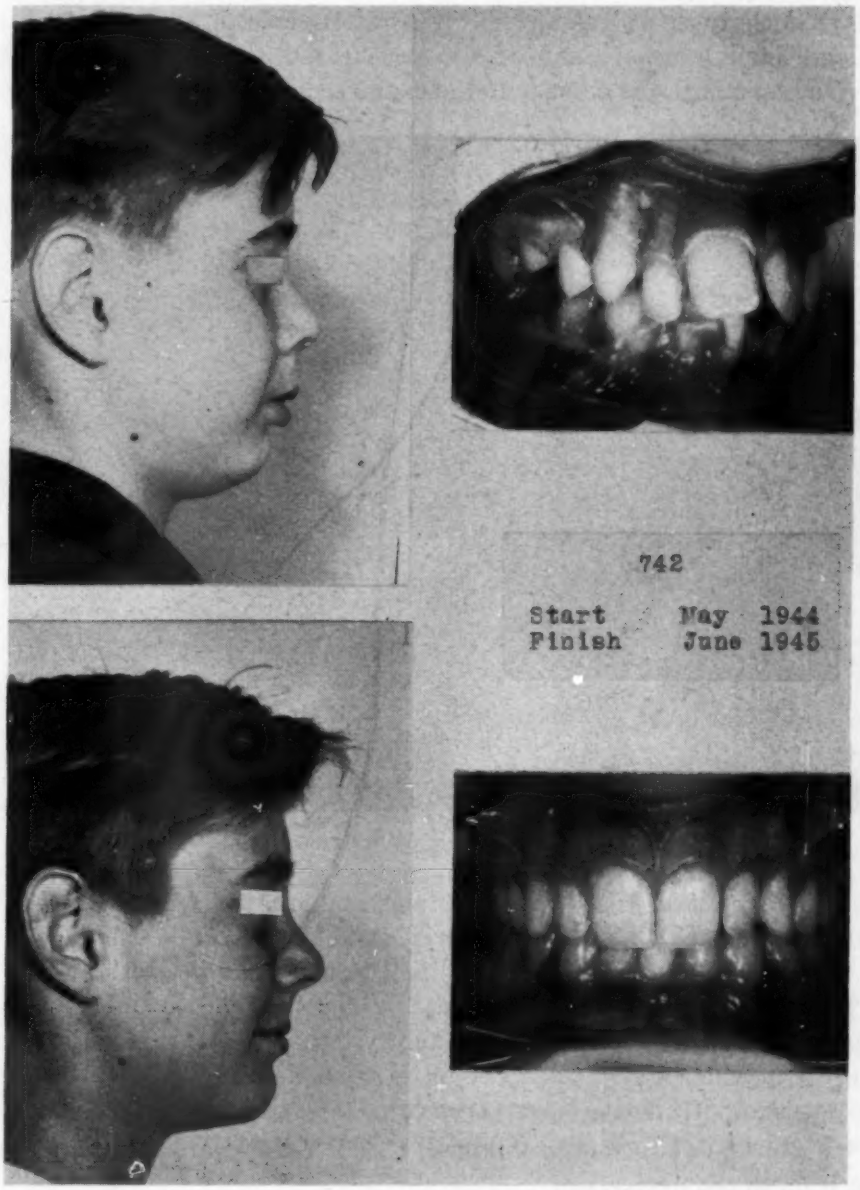

Fig. 7B. *(For legend, see opposite page.)*

position, establish arch form, and secure favorable cuspal interdigitation. In the average case not complicated by extreme maldevelopment of the jaws, treatment extends beyond twelve months only in the event of absence or sickness or extended vacations of the orthodontist.

It is required, of course, that the time schedule should be maintained and everything done that is indicated at each appointment. When the treatment time is twelve months or less, it means that the lower anterior bands have been in place only six months, the upper anterior bands only two months, and the remaining bands for the full course of treatment. With reasonable care and attention by the patient and orthodontist, there will be no etching marks on the cervical enamel areas of the teeth. When treatment extends beyond twelve months and bands are not removed and recemented, there is great danger with each succeeding month for damage to the enamel.

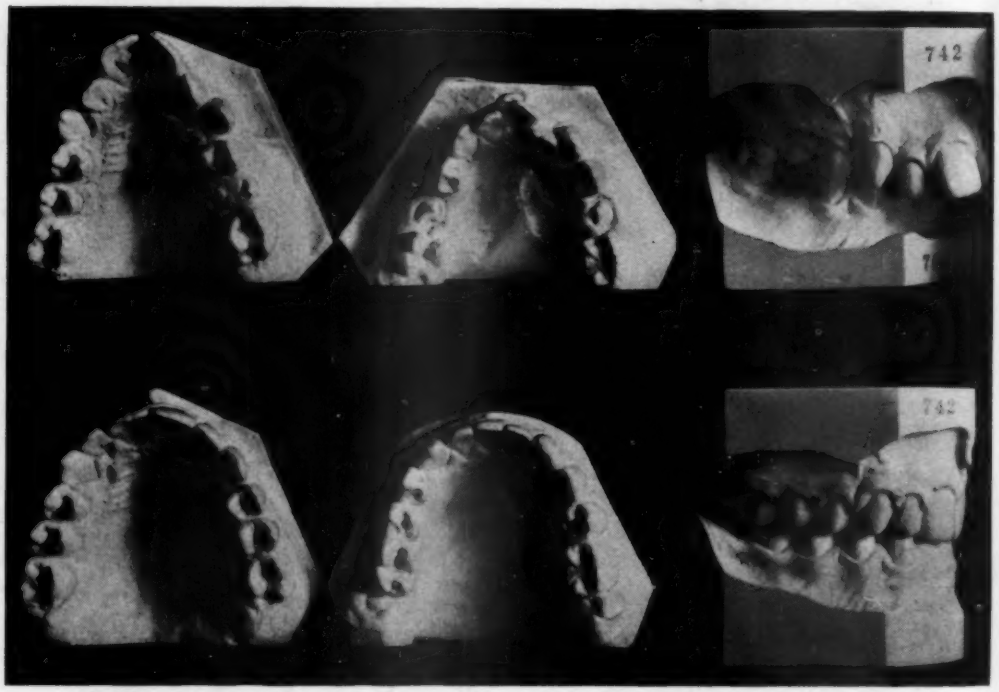

Fig. 7C. (*For legend, see page 18.*)

Those of you who wish to follow this technique may not be successful at first attempt. It takes time and experience to learn how to handle the mechanism. If you follow the steps as outlined, you will know just what to expect in the progress of the case. Any deviation from the time schedule can be recognized at once and may be attributed to faulty technique or poor patient cooperation, to rectify which action should be taken immediately.

If this method of treatment helps you to treat your cases with better results than you have previously obtained, I shall feel rewarded for my efforts in passing it on to the profession.

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MANDIBULAR INCISOR POSITION RELATIVE TO BASAL BONE

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THE general purpose of this study is to analyze, by means of standardized lateral head roentgenograms, the relationship of the lower anterior teeth to the base of the mandible.

The investigative work on this subject is divisible into three progressive stages. First, investigators observed the forward movements of teeth on the base of the mandible, especially that of the lower incisors during orthodontic treatment. Second, there developed an interest in the correct angulation of the lower incisors with regard to the basal bone. Third, in this study, the position of the lower incisor teeth has been determined relative to the basal bone, specifically with reference to the bony chin point or menton.

Grieve was one of the earliest to notice and describe the general tendency for the teeth to move forward on their bases in certain cases of malocclusion. This forward movement of the teeth was referred to by him as the "forward translation theory." In one of Grieve's earlier papers (1937), he wrote:

> After wasting valuable time for seven years, I am now finally awakened to the realization of the fact that malocclusion, as a general rule, is the result of a forward translation of the teeth.

Many orthodontists accepted Grieve's theory as is indicated in one of his recent papers (1944):

> Sim Wallace's theory of the forward translation of teeth, based on Hunter's "Description of the Growth of the Jaws," which I have had the pleasure of championing for the past eighteen or more years, has now become pretty well established as a fundamental truth. The work of Dr. Charles H. Tweed has added further emphasis to this hypothesis. He has also clarified Angle's line of occlusion, which I would suggest might now rightly be understood as forming the basis of the science of orthodontics.
>
> Different authors, including Strang in 1924, and Angle in 1925, when he introduced his edgewise mechanism, called attention to the forward migration of teeth. It is very gratifying, now, to note the number of prominent orthodontists expressing their belief in this theory, which, I said several years ago, would some day become established as a scientific principle to guide us in the analysis and treatment of our cases.

Tweed has been a particularly ardent supporter of the "forward drift" theory of malocclusion. In a foreword to a (1941) paper of Tweed's, Strang stressed that part of the basis for Tweed's philosophy of treatment is: "That

Read before the Forty-Third Annual Meeting of the American Association of Orthodontists, Colorado Springs, Colo., Sept. 30-Oct. 3, 1946.

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practically all malocclusions are characterized by a forward drift of the teeth in relation to their basal bones."

In the paper itself Tweed made the following statements:

> The great majority of Class I malocclusions that have come under my observation are in reality the beginning of bimaxillary protrusions.
>
> Some of the so-called simple Class I cases, I have found difficult to retain after treatment. The individual teeth are too far forward in relation to their respective jawbones and the denture is therefore mechanically unsound and cannot withstand the forces exerted upon it incidental to function. The frequency with which it collapses, particularly in the incisal region is, to say the least, alarming.

More recently, Tweed (1945) has expressed his viewpoint as follows:

> Virtually all malocclusions are characterized by a forward drift of the teeth in relation to their basal bones. Owing to lack of growth in the body of the mandible anterior to the rami, there is often a discrepancy between tooth anatomy and osseous basal structure which makes it impossible for all the teeth anterior to the first molars to assume normal positions on basal bone. Such a discrepancy may occur even when the first permanent molars are normally positioned with relation to basal bone.

Since the lower incisors seemed to be the worst offenders in this "forward drift" relationship, orthodontists became interested in determining the correct angulation of the lower incisors to the base of the mandible. This interest was presumably based upon the observation that individuals having good occlusion seemed to have lower incisors at a fairly constant angle relative to the mandibular base. It was also claimed to be supported by the fact that corrected orthodontic cases suffered no appreciable relapses if at the end of treatment the lower incisors had an angulation approximating that of good normal occlusion.

Among those first attempting to determine the correct lower incisal angulation to the mandibular base were Brodie (1940), Tweed (1941), Margolis (1943), and Speidel (1944).

Tweed writes:

> In order to become more familiar with the normal relation of the mandibular teeth, especially the incisors, to basal bone, I made a study of the mouths of individuals with normal occlusion. The growth and development of both the dentures and faces of these people had apparently followed normal growth patterns, since none of them had required orthodontic aid.
>
> Accurate profile photographs were taken of my subjects, and plaster models were made of their mouths. These models were then cut through the median line. A study of these cross sections through the body of the mandible and alveolar process at the median line demonstrated that in each instance the mandibular incisors overlay the basal ridge of bone, which is that portion of the body of the mandible on which the alveolar process rests. Further careful observation and study of the relation of the mandibular incisors to their basal bones were made, and these relationships were correlated with the fine balance

and harmony of facial esthetics virtually always found in such cases. . . .

In normal occlusion the mandibular incisors are always positioned on mandibular basal bone within the range of the normal variation of minus 5 to plus 5.

The figures plus-minus 5 appear to be in degrees, although Tweed does not specify this. By minus 5, it is inferred that the inclination of the incisors with respect to the mandibular basal bone is less than 90 degrees with the lower incisors deviating lingually up to 5 degrees. By plus 5 this inclination of incisors is more than 90 degrees with the lower incisors deviating labially up to 5 degrees. Although Tweed implies that the inclination of the incisors, determined by him, is with respect to the mandibular basal bone, it is actually measured relative to the occlusal plane, since, as he states, "The bases of all these models are cut parallel to the occlusal plane."

Brodie, Margolis, Speidel, and others used fixed standardized profile roentgenograms of normal children and adults to determine the inclination of the lower incisors with respect to mandibular basal bone. The results obtained were almost identical with those of Tweed. However, the procedure used by these investigators was that of drawing a base line tangent to the lower border of the mandible on the profile roentgenogram (Fig. 1). This line has become known as the mandibular plane. A vertical line was then drawn through the long axis of the mandibular central incisor to the base line, forming, with the base line, what has been called, "the incisor mandibular angle." Although the normal individuals examined by these men showed a lower incisor inclination range from 83.5 to 99 degrees, the majority of the cases showed an average incisor mandibular angle close to 90 degrees with a standard spread of not more than five degrees in either direction.

Summarizing the results of all these investigators, Speidel wrote:

It is quite satisfying to note, after these data were assembled, that a study by Margolis was published concerning the relationship of the incisor axis to one of these tangents, the lower border of the mandible, and that his findings agreed very well with the portion of our data which deals with this same relationship. Likewise, unpublished data assembled by Brodie, by Broadbent, and by Noyes, Rushing, and Sims which were recently presented by Brodie showed remarkably similar average values for the relationship between mandibular incisor axis and the tangent to lower border of mandible.

All of the studies cited considered only the lower incisor inclination with relation to the mandibular base, although Tweed's statements would imply that he included the position of the lower incisors relative to mandibular basal bone in his study. Obviously, this could not be true since intraoral impressions do not reproduce mandibular basal bone in the plaster casts.

Higley (1944) in addition to the consideration of axial inclination of the lower incisors to the mandibular plane, presents a pertinent discussion of the position of the lower incisors to the basal bone of the mandible especially with respect to the menton.

Three extracts from this discussion follow:

(1) Consideration of two other relationships, those of the mandibular incisors to the menton, or bony chin, and mandibular plane (indicated by a line tangent to the inferior border of the mandible) is timely

Fig. 1.—Photographs of fixed profile roentgenograms. The mandible has been outlined and a line has been drawn tangent to its lower border known as the mandibular plane. Another line through the long axis of the central incisor is extended to cross the tangent. The angle formed by these lines has been called the incisor mandibular angle (Margolis).

because of the interest manifest in Tweed's new philosophy of treatment and the subsequent revival of interest in the "forward translation theory" advanced some years ago by Grieve, who stated that "excessive overbite, and overjet . . . result chiefly from insufficient growth of the jaws and consequent forward translation of the teeth." However,

we shall see, with the ample cephalometric evidence now available, that this observation can be questioned, at least as far as the mandibular incisors are concerned.

(2) Margolis recently published an excellent report on a cephalometric analysis of the axial inclination of the mandibular incisors with respect to the lower border of the mandible, in which he concluded that "for the vast majority of white children treated by orthodontists, the best results are obtained when the mandibular incisors are vertical and form a right angle with the mandibular plane.

(3) While this knowledge of axial inclination is valuable, what must be emphasized as even more important is the fact that various persons may have the same acceptable axial inclination relationship of the mandibular incisors to the mandibular plane, but these incisors may be over the chin point or a considerable distance back of it. Both Tweed and Margolis recognize this possibility, but have not discussed it. The question as to what constitutes a normal or acceptable relation of the mandibular incisors to the menton might then logically arise.

The purpose of the present study, is, therefore, to extend Higley's original investigations of the position of the lower incisors relative to the basal bone of the mandible, especially to the menton or bony chin.

PROCEDURE

The material for this study consisted of standardized profile roentgenograms of four hundred fifty-two patients from the orthodontic files of the College of Dentistry, State University of Iowa. These patients came, for the most part, from the professional and higher income white families living in Iowa City and its environs. The ages varied from 4 to 25 years, the majority being between 6 and 12 years inclusive.

Specific aims in this study included the following:

1. To investigate the relationship of the lower anterior teeth to the bony base of the mandible in individuals having normal dentofacial relationships.

2. To investigate the relationship of the lower anterior teeth to the bony base of the mandible in dentofacial deformity of the Class II (Angle) type.

3. To investigate the relationship of the lower anterior teeth to the base of the mandible according to age and sex.

The material was divided into two main groups: (A) Normals and (Angle) Class I type of malocclusion. (B) (Angle) Class II type of dentofacial deformity. In group A the mesiodistal relationship of the dental arches is correct. In group B the mandible with its superimposed dental arch appears to be distal to the upper arch.

The lower incisor and mandibular outlines of each roentgenogram were traced, and on each tracing two straight lines were drawn: a line tangent to the lower border of the mandible (mandibular plane), and a line tangent to the menton bisecting the former at right angles. The shortest distance between the labial surface of the lower incisor and the latter line was measured and tabulated, as represented in Fig. 2. When the roentgenograms showed two mandibular shadows, the lower outline was taken (see Fig. 3, *A*).

Groups A and B were subdivided into three age groups: the youngest group being from 4 to 7 years, the middle group from 8 to 15 years, and the oldest group from 16 years to adulthood. They were further subdivided into males and females.

The mean, median (typical value), interquartile zone (zone within which the middle half of the group fell), and the range (maximum plus and minus values) were determined for groups A and B. For the subdivisions of groups A and B, the mean was computed.

Fig. 2.—Typical tracing of the profile roentgenogram with the base line drawn tangent to the lower border of the mandible and a vertical line at right angles to the base line and tangent to the menton or bony chin point. The vertical line is designated as zero, with all measurements posterior to it given a minus value and all anterior a plus value.

FINDINGS

From the total four hundred fifty-two standardized profile roentgenograms, three hundred seventy-three were found to belong to group A (normals and Class I malocclusions), and seventy-nine to belong to group B (Class II dentofacial deformity).

All measurements were expressed in millimeters. The vertical line tangent to the menton was designated as of zero value, and all measurements forward of this line were expressed as a plus value, while all measurements that fell posterior to this line were given a minus value (Figs. 2 and 3).

Two cases in group A and one case in group B were found to have the lower incisors jutting beyond the perpendicular line tangent to the menton.

The mean distance between the labial surface of the lower incisors and the vertical line tangent to the menton for group A was –8.16 mm., and for group B –8.20 mm.

The median (typical value) for group A was –7.4 mm., and for group B was –8.0 mm.

The interquartile zone for group A was from –9.6 to –5.7 mm., and for group B it was from –9.9 to –6.0 mm.

The range which included all the cases in group A extended from –19.0 mm. (posterior to the menton) to +2.0 mm. (anterior to the menton). The similar range for group B was from –19.5 to +2.0 mm. The mean value for Division 1 of group B was –8.07 mm., and for Division 2 it was –8.74 mm. There

A. *B.* *C.*

Fig. 3.—Photographs of three profile roentgenograms. The white lines are the mand bular plane, tangent to the lower border of the mandible, and the right angle vertical line tangent to the bony chin point (menton). The deformity of each patient is of about equal severity and of the Class II, Division 1 (Angle) type. *A* has a comparatively short mandible but the incisor teeth are back of or on the minus side of the vertical line. *B* has an average-size mandible and the incisor teeth are about the average distance in back of the vertical line, while *C* has the lower incisors a considerable distance back of the vertical line. (Courtesy of L. B. Higley.)

were only 12 cases in Division 2, the range being from –16.3 to –5.2 mm. The range for Division 1 was from –19.5 to +2.0 mm.

Upon subdividing groups A and B into the three age groups, the results were as follows:

1. The youngest group (4 to 7 years) showed a mean value of –6.40 mm. for group A, and a value of –7.47 mm. for group B.

2. The middle group (8 to 15 years) showed a mean value of –6.81 mm. for group A, and a value of –8.03 mm. for group B.

3. The oldest group (16 years to adulthood) showed a mean value of –10.29 mm. for group A, and a value of –9.40 mm. for group B.

Further subdivision of groups A and B into males and females produced no appreciable difference. The mean value for the males was –8.62 mm. in contrast to –7.85 mm. for the females. A condensation of the foregoing findings is presented in Table I.

TABLE I. POSITION OF THE LOWER INCISORS ON THE MANDIBULAR BASE: RELATIVE TO THE MENTON

(Measurements [millimeters]: White children of professional and upper income group, from the orthodontic files of the College of Dentistry, State University of Iowa)

VALUES FOR TOTAL SAMPLE

	N	MEAN	MEDIAN	INTER. ZONE	RANGE
Group A	373	-8.16	-7.4	-9.6 to -5.7	-19.0 to +2.0
Group B	79	-8.20	-8.0	-9.9 to -6.0	-19.5 to +2.0

VALUES FOR AGE SUBGROUPS

	4-7 YEARS		8-15 YEARS		16 YEARS AND UP	
	N	MEAN	N	MEAN	N	MEAN
Group A	104	-6.40	135	-6.81	80	-10.29
Group B	12	-7.47	58	-8.03	9	- 9.40

VALUES FOR SEX SUBGROUPS

	GROUP A		GROUP B		GROUPS A AND B	
	N	MEAN	N	MEAN	N	MEAN
Males	213	-6.87	34	-8.13	247	-8.62
Females	113	-7.25	45	-8.52	158	-7.85

VALUES FOR DIVISIONS OF GROUP B

DIVISION 1		DIVISION 2	
N	MEAN	N	MEAN
67	-8.07	12	-8.74

Group A contains normal occlusion and Class I malocclusions.
Group B contains Class II dentofacial deformities.
–, A negative figure denotes the lower incisor position to be posterior to the menton.
+, A positive figure denotes the lower incisor position to be anterior to the menton.

SUMMARY AND CONCLUSIONS

Four hundred fifty-two standardized lateral cephalometric roentgenograms were used for this study. This material was obtained from the orthodontic files of the College of Dentistry, State University of Iowa.

Three hundred seventy-three of the total roentgenograms had either normal occlusion or a Class I type of malocclusion. These were collected together

as one group (A). In these cases the relationship of the dental arches mesiodistally was correct.

Seventy-nine roentgenograms were classified as Class II type of dentofacial deformity and were designated as group B. In these cases the mandible with its superimposed dental arch appeared to be distal to normal with respect to the maxilla.

The lower incisor and mandibular outlines of each roentgenogram were traced and tabulated in the proper groups. The shortest distance between the labial surface of the lower incisor outline and a line perpendicular to the mandibular base line (mandibular plane) and tangent to the menton was measured.

It became apparent when all pertinent data had been collected that both groups and their subdivisions were remarkably similar to one another, the lower incisors having a mean value of about 8 millimeters in back of the menton on the mandibular base line (mandibular plane).

The data in this study, compounded from analysis of profile roentgenograms, does not support the contention that the lower teeth in Class II dentofacial deformities are too far forward on their basal bone. On the contrary, it shows that the lower teeth have approximately the same relative position to the basal bone in Class II deformities as in normal occlusion and Class I malocclusions.

Undoubtedly, those who contend that the lower incisors are too far forward on the basal bone have considered inclination only with respect to the mandibular plane or the occlusal plane, and not the position of these incisor teeth with respect to basal bone. Position is undoubtedly as important as inclination if not more so.

This study was primarily concerned with the relative position of the lower incisor crowns to the menton, without much attention being given to the inclination of the incisors or the position of the root apices relative to the basal bone.

To complete the picture, a study of the inclination and relation of the incisor tooth apices to the labiolingual diameter of the mandibular basal bone is now in progress.

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THE GROWTH OF THE MANDIBLE

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NO INTRODUCTION is needed if one is to talk on the growth of the face, or part of the face, before a meeting of orthodontists, because they are the ones who not only talk about growth of the human body but also try to do something about it. However, if one wants to do something about it, then it is imperative that one know all the details of growth and how it manifests itself.

There are several questions that need an answer. How much does any part of the body grow, and when? It is also necessary to know where it grows, and how. The two latter questions will be in the foreground of the discussion.

If one discusses the growth of bone, the mandible for instance, one has to recognize that it is entirely different whether one speaks of growth of bone tissue, or of growth of a bone as an organ, because a bone, the mandible, for instance, consists not only of bone; there is also cartilage and connective tissue, marrow, nerves, and vessels.

The need for this differentiation is easily demonstrated. Bone tissue grows only by apposition. Interstitial growth of bone does not exist, and this statement is unqualified and unequivocal. In spite of this knowledge, almost every year an article is published in which the specter of interstitial growth of bone is raised. People who exhume this specter do not even bother to put a little meat on its bones. There are no experimental data, nor any histological data; the long dead and buried "interstitial growth of bone" is just taken out of the coffin again. It is a pity that this should happen so often.

Bone tissue grows by apposition on any surface, outer or inner, of a bone. New layers of bone can be added, for instance in a spongy bone on the surfaces of the bone trabeculae. By this growth of bone tissue, the bone in which this occurs has not grown, has not been enlarged, it is only heavier by osteosclerosis.

Some remarks are necessary to define the two types of growth, interstitial and appositional growth. In interstitial growth of a tissue, cells inside a block of tissue multiply by division and produce more of the intercellular substance, and thus this tissue grows by expansion from within. All the soft tissues, including cartilage, grow in this way.

Hard tissues, bone, cementum, dentine, cannot possibly grow by expansion. These tissues grow by apposition, new layers being laid down upon the old layers. One important fact has been neglected, though it has been known for a long time: cartilage, just as it stands physically between soft connective tissue and hard bone, can grow, and grows by both modes of growth, interstitially, that is, by expansion, and appositionally by addition.

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In a section of the cartilagenous part of a rib, for instance, there is no sharp division between the connective tissue of the perichondrium and the cartilage. The deepest layers of the perichondrium change gradually into cartilage. The connective tissue cells assume a new function, a new shape, and cartilage is now apposed, added from the perichondral surface, to that which has been already present.

Some cartilage grows both by interstitial proliferation of cells and production of more intercellular substance, and by apposition of new material on the outer surface. However, the fact has to be stressed that appositional growth of cartilage can, of course, occur only where the cartilage is covered by connective tissue. Articular cartilage which has a free surface facing the articular space can grow thicker only by interstitial growth.

A long or tubular bone, for instance the humerus, is laid down first in cartilage, that is, a model of cartilage is gradually replaced by bone. When an age of 8 or 10 years has been reached, such a bone consists diagrammatically of three bony parts: a central shaft or diaphysis, and two terminal parts, the epiphyses, and four layers of cartilage. Between shaft and epiphyses there is a plate of cartilage on either end and another layer of cartilage covers the two articular surfaces. The epiphyseal plate of cartilage is the growth center for the shaft, the articular cartilage, the growth center for the epiphysis.

Assuming that these plates of cartilage proliferate for a time while nothing else happens, then the bone as a whole would be longer. Growth of cartilage has elongated the bone. That parts of the proliferating cartilage are replaced by bone will not and cannot increase the size of the bone. The replacement of cartilage by bone is, however, necessary for functional reasons.

Proliferation of cartilage elongates a bone, but it grows transversally by growth of bone tissue itself. In a cross section of a bone, bone is laid down along its outer surface and by this proliferation of bone tissue the bone gets thicker; but at the same time the marrow space is widened by resorption of bone from the inside.

What does it mean that proliferation of cartilage elongates, proliferation of bone tissue thickens a bone? The anthropologists and physicians divide mankind into several types according to the body build. One is the longitudinal type, the long, narrow-chested individual with long extremities and a narrow, long face. Another is the stocky type, the lateral type, where proportions are just the opposite. That cartilage growth elongates, bone tissue growth thickens a bone gives us at least a formula by which to express the genesis of these types.

In the average type, somewhere between stocky and elongated, growth of cartilage and growth of bone tissue are in equilibrium. In an individual in whom cartilage grows a little more than it should, and bone less, the effect will be that the bones will grow long but will remain thin and the whole body will develop accordingly. If the cartilage grows not as much as it should, but the bone tissue grows normally, then the bones, and so the body, will be relatively short and relatively massive.

Also, in the growth of the mandible, growth of cartilage and growth of bone play the dual role of making the mandible as a whole grow. Growth of the mandible, though it is the effect of growth of cartilage and bone tissue and modeling resorption, is still much more complicated than that of long bones.

The condyle of the mandible contains a cartilage up to the late twenties, but this cartilage has been very much misrepresented in the literature. Some maintain that it is an articular cartilage; others identify it as an epiphyseal cartilage analogous to that existing in long bones. It is neither. In a young individual the bony part of the mandibular condyle is overlaid by a cap of cartilage, but this in turn is covered by a thick layer of connective tissue which continues into the periosteum of the mandibular neck.

In a long bone, epiphyseal and articular cartilages grow in length only by interstitial growth, since their surfaces are not covered by connective tissue, which, by differentiating, could enlarge the cartilage by apposition. These cartilages have to grow from within. In the mandibular condyle the cartilage grows in the same manner; however, it can also, and it does, grow by appositional growth from the deepest layers of the covering fibrous tissue.

This detail is most important if one wants to visualize the growth of the mandible. The elongation of a long bone by proliferation of cartilage is only by interstitial growth of cartilage. The elongation of the neck of the mandible by proliferation of cartilage is by interstitional and appositional growth of this cartilage.

A tubular bone and also the mandible grow not only by proliferation of cartilage but also by proliferation of bone itself. By the proliferation of the condylar cartilage the mandible grows longer and higher and wider. If the over-all length of the mandible increases, the height of the mandible increases at the same time. The divergence of the rami causes simultaneously the intercondylar distance to grow. These facts are of utmost importance because they show that the proliferation of the condylar cartilage makes the mandible at the same time grow in three dimensions: It grows longer, higher, and wider.

This means that if a mandible is stunted in its growth and is therefore shorter, as in some cases of Class II, it is of necessity also not high enough. Conversely, if a mandible overgrows it it not only longer, but it is also higher.

In addition to growth of cartilage and its replacement by bone, bone tissue itself is laid down at the posterior border of the ramus, at the upper border of the coronoid process, and at the alveolar crests. The mandibular body grows in height very little by apposition on its lower border, which only serves to make it more robust. It grows in height by addition of bone on the free borders of the alveolar process. At the same time, at the anterior border of the ramus, bone is resorbed so that room is provided for the successive eruption of all the teeth.

Growth of the mandible has also to be considered in relation to the cranium. Being in contact with the temporal bone in the articulating fossa, a growth increment at the upper and posterior end of the mandible will make it move downward and forward. True, the mandible grows at its upper posterior end, but this growth makes the entire mandible grow or move down and forward. This

fact again is important, because it can be seen that the growth of the mandible is also necessary and indispensable for the growth of the upper face. By the mandibular growth the space is being opened between the upper and lower jaws, and both upper and lower jaw grow into this space, and both upper and lower teeth erupt into this space.

Growth of the mandible and, primarily, growth of the condylar cartilage determines, therefore, the development of the whole face. In an individual of the stocky type, slow cartilaginous growth causes a short but heavy mandibular ramus with a smaller mandibular angle. The entire facial height is secondarily reduced; the face is wide and short. The opposite is true in the narrow, elongated, long-limbed type of man. Here the mandible has a long and narrow ramus, with a wide angle, because here cartilage grows relatively fast. The facial height is increased, the face is narrow and long.

The cranium, that is, the skull minus mandible, can be considered as one unit of bones. While its base grows by proliferation of cartilage, it enlarges at its convexity by sutural growth. The upper face also is the site of growth at sutures. In addition, bone itself is laid down on surfaces of the cranial bones. What is sutural growth? It is often explained as appositional growth of the two bones linked to each other at a suture. If this were true, sutural growth would be at an end almost before it began, and a bony union of the bones would result.

It was shown a long time ago (though unfortunately it is neglected very often) that the primary event in sutural growth is the proliferation of the connective tissue between the two bones. If the sutural connective tissue proliferates, it creates the space for appositional growth at the borders of two bones. The replacement of the proliferating connective tissue by bone is of course necessary for the development of functionally adequate bones. The enlargement of the brain cavity, however, is not by proliferation of bone but by proliferation of the connective tissue in the sutures.

The sutures which are most important in the growth of the upper jaw are the suture between frontal process of maxilla and frontal bone, the suture between zygomatic bone and maxilla, and the suture between the pyramidal process of the palatine bone, which is part of the maxillary complex of bones, and the pterygoid process of the sphenoid bone. These sutures are all parallel, and all slant downward and backward. If connective tissue proliferates in these sutures, the maxillary complex would move downward and forward, and that is exactly what really occurs. The downward and forward movement of the maxilla by sutural growth, that is, by proliferation of connective tissue in the sutures, does not account for the full development and growth of the maxilla; the subnasal part of the maxilla, mainly the alveolar process, grows by apposition of bone at the alveolar border. Into the space opened up by the condylar growth of the mandible the maxilla is not only passively moved but also grows actively at the free borders of the alveolar process. In this general downward and forward movement, the sutural growth will contribute more to the forward than to the downward growth, and the growth at the border of the alveolar

process more to the downward than to the forward growth. This is the reason why primary changes of mandibular growth may cause characteristic secondary changes in the upper face.

A primary underdevelopment of the mandible, as in some cases of Class II malocclusion, may not be able to impede the sutural growth by which the maxilla grows forward and downward; but the growth of the alveolar process is impaired and it does not grow sufficiently downward; the result is an apparent protrusion of the maxilla secondary to the underdevelopment of the mandible.

Conversely, a primary overgrowth of the mandible, as in some cases of Class III, does not lead to additional sutural growth, but to an isolated overgrowth of the alveolar process of the maxilla. The maxilla grows forward and downward to a normal extent but the downward component is accentuated. Then the maxilla appears to be retruded. The retrusion of the maxilla in Class III may again be secondary to the overgrowth of the mandible.

In the preceding discussion the mandible has been placed in the center of facial growth changes. This assumption gains strength from the fact that the cartilage in the mandibular condyle does not grow as much interstitially as appositionally. The growth of the cartilage in the mandible, therefore, may be inhibited or stimulated by factors which do not interfere with the interstitial growth of cartilage in other bones. For instance, chondrodystrophic dwarfs, the midgets of the sideshows, are short; their cranial base is short, the forehead bulges, and the face appears flat. However, their mandible is not smaller; on the contrary, very often it protrudes. A dystrophy of cartilage, an inhibition of cartilaginous growth, is the cause of this type of dwarfism. However, the genetic disturbance which causes this dwarfism interferes with the interstitial growth of cartilage only, and not with its appositional growth.

In an English bull or a King Charles or a Pekinese, that is, in dogs which suffer a partial chondrodystrophy restricted to the skull, the rounded brain case is bulging. The upper jaw is shortened, but the mandible protrudes. Here the interstitial growth of cartilage is inhibited and, therefore, the cranial base cannot attain its normal length. The appositional growth of cartilage, the differentiation of connective tissue into cartilage, is not inhibited; therefore, the cartilage at the condyle grows at a fairly normal rate and the lower jaw is not stunted to a degree equal to that of the cranial base.

A few remarks are necessary concerning the genetic pattern and the inability to change it, and the pessimistic outlook against which so many orthodontists are fighting and which many accept as a limitation of orthodontic endeavor.

In order to understand genetic pattern one has to realize the difference between the genotype, which depends on the inherited set of genes, and the phenotype, the manifest characters of an individual. The genotype is transmitted to the offspring, not as the character itself but as its primordium which has to be evolved and unfolded and elaborated during individual development and growth. One can interfere, and nature often does interfere, with this process of unfolding. It is a well-known fact that a plant, which by its genetic make-up

should attain a certain height, can be stunted if, for instance, it is not given enough water. In pituitary giantism, where too much growth hormone is produced, the individual does not attain the height he has inherited, but grows to be much taller. What can be observed in an individual is not the genotype, it is not the effect of a genetic pattern but of a genetic pattern plus the factors which have stimulated its evolution, and minus the factors which have inhibited it.

The harmony of the genetic pattern can be broken by environmental factors, and, when more about these agents is known, the physician or the orthodontist will be able to do more about it. There is not the slightest reason why one should become overly pessimistic in overevaluating the genetic determination of the individual. A disharmony in facial growth is by no means always caused by an inherited distortion of its pattern. It may be due to an inhibition of the elaboration, the unfolding, of this pattern. Knowledge of the normal mechanism of growth is the indispensable premise for an understanding of the causation and development of disharmonies of growth.

WHEN TO START ORTHODONTIC TREATMENT CONSIDERING AGE AND RELATIVE GROWTH

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> The body might be compared to a wonderful high-powered machine in which all parts must work together. Poor teeth are the broken bearings, which slow down the machine and may cause it to be thrown into the junk heap. (Author unknown.)

INTRODUCTION

WHEN to start orthodontic treatment is one of the most discussed and one of the most controversial phases in dentistry and of orthodontic education. Just as we have various sides and reasonings to all branches of dentistry and all phases of dentistry, so do we have the same thing occurring as orthodontic problems. Great thinkers from the most remote times have written on the subject but we are still disputing over definitions and the *ideal systems* and the *ideal time* for initiation of orthodontic treatment. If anyone could discover or frame a system of orthodontic education which would enable orthodontists to avoid or to cope with the dangers of life, and to seize its opportunities and meet its emergencies successfully, he would evidently render us a great service. Such a system would be exceedingly useful.

We are always going to have groups of individuals (the first to try the new and the last to lay the old aside) who have lassoed or framed a system of orthodontic education to meet its own dangers and to enable its members to grasp special opportunities, and they think that their belief is the answer to the orthodontist's prayer.

Truly, this question of "When to Start Orthodontic Treatment" is an important question to the general practitioner of dentistry, the patient, the parent, the physician, the pediatrician, and the orthodontist. Therefore, I should like to present phases of child growth and relative periods of selection for the institution of orthodontic treatment; keeping in mind, of course, that orthodontic treatment should be started whenever oral deformities, whether inherited or acquired, would get progressively worse if treatments were not started. In instances of this sort, orthodontic treatment should be started regardless of the age of the patient.

First, let us consider an embryologic period of growth. If you look at an egg dropped on toast or poached, you will notice a lighter spot on the yolk, about as big as the end of a small lead pencil, which looks as if someone had blistered it with a hot iron. It is a disk like a watch crystal, composed of a multitude of cells. Development in a fresh egg has already gone beyond the

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stage of a single cell—then two series of segments appear, etc. We know only that nature under favorable conditions always brings a chicken, never anything else, out of a hen's egg: and that the chicken is usually healthy. All this work is done within a shell. Nature seems to say, "Keep your clumsy fingers off. If you touch the thing, you'll spoil it." And she is quite right. Here we cannot help her at all. Nature usually attains her end, but she frequently reaches it by a roundabout, and apparently aimless, course. Our interference would be disastrous because we cannot help her much here.

Growth is evidently a slow process and demands time. The complexity of the human body is the explanation of the great length of *childhood.* Nature always hurries the development of the individual as much as she safely can. She takes a short cut whenever this is possible. It is neither wise nor safe to attempt to hurry her still more, and to crowd into childhood *actions* and *processes* which properly belong to youth. Something fundamental and essential will surely be crowded out. We have found that development takes place according to an orderly sequence and that growth is anything but uniform in different parts of the body at any one time. Each part increases in size according to an inner law of its own. From birth to seven months is the first period of rapid jaw growth. Mostly horizontal growth takes place to accommodate the deciduous teeth. This is the period of the most rapid development of the dental arch. Very little vertical growth takes place at this time. From seven months to the beginning of the third year there is some vertical growth because the deciduous teeth are erupting. There is practically no anteroposterior growth.

In the second phase of life from the third to seventh birthday horizontal and vertical growth are taking place, and this is the second period of accelerated growth which occurs as the first permanent molars are erupting. The child at 3 weighs about 30 pounds, at 6 about 45 pounds. The center of growth is shifting from trunk to legs and arms. The child is stretching, shoulders stand out more sharply from the trunk. For this age group you will readily understand that, sometimes, it is necessary to place orthodontic habit breakers or even routine orthodontic appliances in children as young as 3 or 4 years of age. Obviously, this is not the ideal time to begin a *general correction* of the anticipated malocclusion, but sometimes thumb- or finger-sucking, lip-biting, tongue-biting habits start at an early age, 3, 4, or 5 years of age, and these habits should be interrupted and broken as early as possible. We believe that it is better to correct the habit at this early age, which usually requires a few weeks to three months, and then see the child every three to six months, for observational purposes. In no instance do we place the child, at this early age, under routine 2 to 2½- or 3-year orthodontic treatment.

Treatment of dentofacial anomalies before the sixth year should not concern itself with malpositions of single teeth unless these teeth interfere with function and continued development of the dental arches. Orthodontic treatment in deciduous dentition should concern itself with anomalies affecting groups of teeth, the relationship of the jaws to each other and to the cranium and face.

Although diagnosis of malocclusion in the deciduous denture has the same basic considerations as in the permanent dentition, treatment is not usually the same in both dentitions. Treatment in the deciduous dentition may be undertaken as soon as the deciduous tooth roots are fully developed. When mechanical appliances are indicated they should be used in these cases before the deciduous roots show advanced resorption. Otherwise, treatment should be postponed until the permanent incisor teeth have erupted and their roots are nearing completion.

Additional factors which determine time to treat malocclusions are (1) type of malocclusion, (2) severity of malocclusion, (3) age of patient, and (4) health of patient.

Some orthodontists say never to treat until all permanent teeth have erupted. They find it necessary to do a lot of extracting in treating their cases. In my opinion they sacrifice the chance of aiding full and complete jawbone growth in too many cases. Other orthodontists say to treat as soon as any evidence of abnormality is presented. It is true that some cases of this group might have corrected themselves by normal growth and development; therefore, in my opinion, we must have a *thorough* knowledge of growth and development and etiology.

The period of growth between the ages of 6, 7, and 8 to 14 and 15 years of age may be considered the "transition" period of child growth. During this period the deciduous dentition is shed and all of the permanent dentition excepting the third molars erupt. The most intensive growth in width, height, and depth of the face takes place. There is a downward and forward growth of the face. The permanent incisors are coming into occlusion and the second permanent molars are erupting. During this period the child is a strange and interesting being whose organs are at widely different stages of growth. At 6 there is but little difference between the sexes, though the girl already begins to show signs of the precocity which will characterize her future development. The average child at 6 weighs about 45 pounds and at 9 about 60 pounds. The weight at 6 is about one-third of that of the adult. The heart is at a minimum, has hardly more than one-fourth of its adult weight and has to force blood over the body which has two-thirds its adult height already. This is responsible for the child's quick fatigue and this is known as the fatigue year of a child. This is the time when the brain has stopped its rapid increase in weight. The permanent teeth appear, symptoms of a preparation for a change in food and in mode of life. Muscular activity is increasing rapidly. Children between the ages of 8 and 15 may expect, on the average, a 40 to 65 per cent increase of dental caries. The old structure is not fully adapted to the new needs and conditions. It must readapt itself. This period of readaptation, we might almost say of reorganization, is necessarily a period of weakness. If the nervous control of the arteries, the vasomotor apparatus, is still incomplete, as it may well be, we should expect to find the body ill-adapted to meet the new emergencies. Therefore, we should consider orthodontic treatment from 6 to 8 years of age only in the following conditions, as long as the deciduous roots have not been

resorbed to any degree which would interfere with anchorage or make movement of deciduous teeth ineffective:

a. Contraction of the dental arches.
b. Widening of the arches.
c. Distoclusion.
d. Mesioclusion.
e. Cross-bites.
f. Functional and developmental interferences.

We have seen that at about 8 years of age in the boy, the strength of the muscles of the forearm is increasing far more rapidly than other muscles. The motor centers in the cerebrum which control the movements of the forearm and hand are developing very rapidly. The movement of the fingers becomes stronger and more precise. The child is steadily improving in health and vigor. This is a golden time for storing up material and vigor against pubertal metamorphosis, whose lean years are so soon to follow. Curvature of the spine is easily started at the ages of 8, 9, and 10 years, too often directly affecting the positioning of the mandible. You have seen more boys between the ages of 7 and 10 who have wanted to be railroad men, firemen, engineers, policemen, and cowboys, than between the ages of 11 and 14 years. *Imitation* and *suggestion* play a very important part in his life. Many habits, good and bad, which the child does not readily acquire of himself may be developed during this period. Habits which interfere with *normal dental development*, as readily as those of neatness and punctuality, of self-control and courtesy, of truthfulness and reverence, and of a host of other virtues, may thus become thoroughly established. Thus, this period of formation of habits, which seems at first uninteresting and unimportant, proves to be the time of *widest* and *grandest* opportunity for the orthodontist to supervise the correction of habits involving dentofacial areas and interfering with normal development, growth, and function. Habits are especially amenable to early correction and treatment is simpler and of shorter duration. Relapse after orthodontic treatment is less likely to occur and establishment of normal function favors the establishment of normal occlusion.

The tenth year in the girl and the eleventh in the boy are years of very slow growth in both weight and height. A year of slow growth and the beginning of the acceleration of growth in height usher in the critical period of puberty. Now comes a metamorphosis almost as marked as the change of the caterpillar into the butterfly. Every organ in the body is more or less modified. The changes in the girl are probably more profound than in the boy. The girl at 16 has usually attained her full height and practically her adult weight. The boy has somewhat still to gain in both respects. The teeth are organs and they erupt or elongate proportionately in length from the gingiva into occlusion. (Reference is made to crown height.)

Now for the children 8 to 15 years of age, perhaps the most pertinent factors to be considered should be the general health of the child; the ability of the child to masticate his food properly; the arrangement of the teeth in their respective arches; the irregularity of the teeth being associated with an increased

percentage of dental caries; and the child's facial appearance relative to the factors which may contribute to an inferiority complex. There should be definite control of rampant caries either by correction of the diet based upon saliva tests, or by the use of fluorine topically, or by fluoride vitamin tablets plus supervised toothbrushing.

Treatment of the following additional abnormalities may be undertaken in the mixed dentition period:

1. Malrelation of the dental arches.
2. Extreme malocclusion and malrelation of permanent first molars keeping in mind that normal growth change will usually move the mandibular permanent first molars mesially.
3. Definite malocclusion of individual teeth after they have come into occlusion.
4. Elimination of supernumerary teeth.
5. Opening of space to allow erupting permanent teeth to come into occlusion.
6. Correction of labioversion and maxillary incisors.
7. Elimination of dentofacial habits.
8. Approximation of abnormally spaced incisors, after the laterals are in position and the canines show no sign of closing the spaces.
9. Use of space retainers to maintain space of prematurely lost deciduous and permanent teeth.

From the ages of 12 to 20 the eruption of the permanent dentition is completed, the third molars erupt. Some residual vertical growth still takes place in females, but more intensive vertical growth occurs in males. There is again a downward and forward adjustment of the face.

Indications for orthodontic treatment between the ages of 12 and 20 years should be initiated when malocclusion of a correctable nature is present.

Orthodontic treatment of *adults* is possible when performed in accordance with natural functional forces and with due consideration to the biochemical differences of bone as found in the child and in the adult. Bone growth and phosphatase activity are in a more passive state in the adult than in a child.

Rapid growth of bone does not take place in the adult, and osteoclastic activity due to orthodontic tooth movement may exceed osteoblastic activity diminishing the thickness of the labial and buccal alveolar plates when expansion of dental arches is accomplished too rapidly.

Movement of shifted posterior teeth in a mesial or distal direction may be successfully accomplished in adults. Individual tooth movement in labial or lingual direction by means of mechanical appliances may be performed with less danger of relapse, provided this change in position of the teeth brings them in a more favorable relation as far as function is concerned.

After individual tooth movement has been effected, arch expansion may be undertaken. Orthodontic treatment in the adult is thus the reverse of that in the child where arch relating is usually undertaken before positioning of individual teeth. Therefore, malocclusion cases can and are being treated later than 12 and later than 20 years of age in many orthodontic practices today and with very favorable results.

SUMMARY

General skeletal and dental development rather than age should be the determining factor evaluating the presence of malocclusion. Since growth is a dynamic process, and growth periods may overlap and may be difficult to define exactly in all cases, diagnosis and treatment may be synchronized with both the particular stage of growth of the individual patient and the chronologic age in the absence of skeletal retardation or acceleration.

Mershon called attention to the fact that treatment of malocclusion must be synchronized with the general growth of the child. Orthodontic general tooth movement cannot be forced and teeth should not be moved into positions which they would not occupy under normal conditions at the particular stage of maturative growth of the child.

Eby was among the first to point out that since there is a range of difference between chronologic and physiologic age of every person, and the rate of growth varies with the individual, the age of the patient is an indefinite basis for the establishment of diagnosis and treatment of malocclusion.

With the foregoing conditions in mind, children with dentofacial abnormalities have been divided into the following developmental age groups for the purpose of treatment:

Group I.—Age 3 to 6 years.

Conditions indicating treatment include the occurrence of definite functional interferences. These should be observed at periodic intervals and treated if evidence of intensification of the condition, rendering it conducive to malocclusion, is found. The following conditions involving function should be treated during this period:

a. Extreme contraction of the dental arches.

b. Extreme distoclusion.

c. Mesioclusion of the mandible.

d. Cross-bites and other dysfunctional relationships which interfere with normal dentofacial growth.

Group II.—Age 6 to 8 years.

Treatment is indicated in the following conditions as long as the deciduous roots have not been resorbed to any degree which would interfere with anchorage or make movement of deciduous teeth ineffective:

a. Contraction of the dental arches.

b. Widening of the arches.

c. Distoclusion.

d. Mesioclusion.

e. Cross-bites.

f. Functional and developmental interference.

This group possesses a preventive as well as a corrective value. In Groups I and II the primary interest is the correction of abnormalities in the trend of growth and the elimination of functional interferences.

Group III.—Age 8 to 12 years ("transitional period").

Care should be taken not to interfere with the rapid changes in growth such as the forward shift in the position of the molars and eruption of the canines. Contrarily, too much space may be present in the lateral segments. Gross maloc-

clusion should be treated. Extensive tooth movement of newly erupted permanent teeth should be avoided.

Group IV.—Age 12 to 20 years.

Treatment in the permanent dentition should be initiated when malocclusion of a correctable nature is present.

CONCLUSION

The successful practice of every phase of orthodontics, and more especially the prevention and interception of dentofacial deformities, depends in large measure on the proper understanding of growth and development in correlation to genetic tendencies, environmental influences, and the whole gamut of human behavior. The rate and degree of general development and growth achieved by the child largely determine the manner and extent of dentofacial development. Conversely, dentofacial defects often constitute an important index of the abnormalities present in the child as a whole, including his *endocrine, nutritional,* and *metabolic* state.

There is no single growth pattern applicable to the entire human species. Therefore, in our attempt to diagnose and treat abnormality, we must first make certain that a given condition is not merely a phase of growth which might well fall within the range of normality for the individual under consideration. At the same time there are too many abnormalities thought to be a phase of growth, observed too often at *irregular* intervals, thus developing into definite malocclusions. These cases are not referred to the orthodontist early enough to receive the greatest benefit of observation and treatment.

Many abnormal phases of occlusion are transitory and their manifestations may be considered normal only for a particular age and state of development and growth.

Orthodontics is one of the most highly satisfying of all professional services, and each year hundreds of young people in our communities are released knowing that they now have a far greater chance for success and happiness because their general practitioners of dentistry and their orthodontists recognized their difficulty in due time.

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Round-Table Discussion

The Anchorage Problem in Cases Involving Extraction

The discussion was centered around those cases in which the four first premolars had been extracted for the correction of the malocclusion. It was felt that suitable anchorage must be established for the distal bodily movement of the cuspids and to prevent the mesial transformation or drift of the buccal segments. Unless the cuspid is kept upright in drifting distally, an inverted V-shaped space develops between it and the second premolar which is most undesirable and will lead to separation of the contact between these teeth, thus inviting failure of what we hoped to accomplish through the extraction of the first premolars. It was decided that these cases could best be handled by using bands with attachments on the molars, premolars, and cuspids.

For anchorage in the lower arch, a lingual wire seemed best, either removable or soldered to the molar bands. It should contact the lingual surface of the incisors or those teeth that are more lingually located in cases of crowded incisors. It should free the cuspid to allow no contact with this tooth as it is moved distally.

In the upper arch an acrylic plate with wires for stops projecting mesially to the premolars and containing a platform or guide plane seemed to be the most popular. The raised platform lingual to the incisors would keep the buccal teeth out of occlusion, thus allowing the cuspids more freedom in their drifting distally through not being in contact except during meals. The acrylic plate must be trimmed so that it never interferes with the moving of the canines but is in contact with the lingual surface of the rest of the upper teeth.

The consensus of opinion seemed to advocate the use of this anchorage, as soon as the teeth were extracted. They also felt the drifting of the cuspids should be started immediately after the extractions, so the appliances usually should be made and cemented to place before the premolars have been removed.

ROY B. DEAN.

Predetermined Pattern as Diagnostic Aid

The predetermined pattern, to be used as a diagnostic aid, is a setup made by dissecting the teeth from the original orthodontic model and replacing them, in wax, back on their bases. This amounts to a "guinea pig" treatment in so far as the plaster teeth are actually positioned one to another and to the bases as they should be positioned in the mouth during treatment.

The Round-Table Discussion was held at the American Association of Orthodontists Meeting, Broadmoor Hotel, Colorado Springs, Colorado, Sept. 30-Oct. 3, 1946.

If the growth pattern of the patient is good, the lower anteriors are set at about –5°, or are leaning forward 5° from the right angle to the mandibular line. The remaining teeth are then set to these teeth, developing the arch form and axial positioning which is most desirable. If there is insufficient room for all the teeth, first premolars are eliminated and the remaining teeth positioned. In the case of extractions, if the molar teeth do not have to be moved forward on the model, the operator knows he has a serious anchorage problem in treating the case. If it is necessary to move these molar teeth forward in completing the setup, the operator knows that during treatment these teeth may migrate forward to the same extent that they are forward on the model.

If the growth pattern is good, the lower anteriors are set at right angles to the mandibular base. If the growth pattern is only fair, then the lower anteriors must be set at –5°. The remaining teeth are set up in these cases as mentioned before.

By making this "guinea pig" treatment, the orthodontist can recognize the possibilities and limitations of treatment and has an understanding of the anchorage possibilities and the necessary mechanics for completing the case.

HAROLD D. KESLING.

Retainers

Retention, as we all, particularly the older members, know, is the most tedious part of our work. Many months and even years of patient persistent effort are required to make permanent the corrections we have been able to make. The Hawley retainer, so generally used, came as a great relief. In 1944, during the American Association of Orthodontists meeting at Chicago, Dr. Alexander Sved of New York told us of his improvement on the Hawley appliance. The advantages suggested impressed me especially with the clear acrylic material now available. Changing the occlusal level was not accomplished by the Hawley because the upper incisors were not depressed, or retained if depressed, during treatment. Rotations were not held.

I find that many orthodontists who heard or have read Dr. Sved's paper are not taking advantage of its use. It is of this, the greatest retention device ever offered, that I would like to speak. [Various types as samples were produced.]

I have fitted sixty-seven retainers and with two exceptions have found them most successful even with children 7 years of age. After the first day or two they love to wear them. One exception was a girl of 17 years whose six anterior teeth had been rotated. I always stress the importance, the absolute necessity, of wearing the retainer constantly for the first three months. This girl was so proud of her teeth that she went without the retainer for a week, then found that she could not fit it to place. Acrylic is so elastic that it will actually bring rotations back to position if the retainer is not left off too long. This girl had to have all her appliances put back and it was eight months before a new impression could be taken. The other exception was a boy with a deep

overbite. Although I had used crowns on the lower molars to open the bite, wearing the intermaxillary rubbers did not open the bite enough. The lower incisors jammed against the distal of the uppers with no progress. Other corrections having been made, I fitted the retainer, grinding the plate so that all lower incisors were occluding evenly in the groove and leaving the molars apart 2.5 mm. After it had been worn four months the molars came up to occlusion but were still distal. Upper bands were again replaced and intermaxillary elastics were worn for six months. Normal occlusion now having been established, a new retainer was made with a substantial groove for the lower incisor bite. I anticipate no further trouble. I call this a two-step bite retainer treatment.

In view of the fact that it is estimated that 65 per cent of the cases presented at our offices are distoclusion cases, many of them deep overbites, this retainer is of greatest importance. It is possible to correct the irregularities and rotations in one year of treatment, and, if elastics are worn continuously, every minute of the day and night, the molars will be in normal relation in the same time. With incisors in perfect alignment, the upper impression is taken and the retainer fitted so that the molars do not occlude by about 2 mm. The patient will soon be on a one-visit-per-month basis for checkup, and the worry of retention is over except for the lowers.

As there is no comparison between the results obtained with the Hawley retainer and Dr. Sved's retainer, I would suggest that we give it the name of the Sved Bite Retainer. To avoid breakage I have added three strips of chrome matting as reinforcement.

J. Camp Dean.

Mixed Dentition Diagnosis and Treatment

The advisability of treating the average mixed dentition malocclusion seemed to be of the greatest interest to those present and, as most of the participants knew that I have spent many years in the study of this subject, the discussion was rather closely confined to the subject assigned.

The majority of the queries were along the lines of why are most mixed dentition malocclusions worse after treatment than before treatment was begun. A short report such as this does not allow for an adequate answer to so large a question and, since my paper covering the results of my investigations on this subject will soon be published, I shall not attempt to give an answer here.

Hays N. Nance.

REPORT OF THE COMMITTEE ON EDUCATION

The Committee on Education had no duty assigned to it and had no suggestions from the Board to serve as a guide. Nothing has come up during the year to command special attention. However, there are a number of considerations pertaining to orthodontic education that we feel should be noted by the Board, as we, the official body of orthodontists in North America—and the world—should be cognizant of the status of courses being offered as to their scope and content. To this end the following is offered for your consideration:

We feel that a momentous advance has recently been made. Less than ten years ago, with the Survey of Dental Education and the establishing of the Dental Educational Council, there was considerable opinion expressed by some influential faculty members and by nondental executives that orthodontics should be regarded as a part of general practice and that college faculties should teach clinical orthodontics in preparation for such practice upon graduation from the dental school. We have held firmly to the conviction that orthodontics is a distinct specialty of dentistry and that no medical or dental school ever even pretended to prepare its undergraduates for specialization in any branch upon graduation.

After several years of discussion of this problem, we feel that it is safe to say that dental schools quite generally are accepting this as true. Evidence is to be found in the increasing number of graduate courses in orthodontics that are being offered by university dental schools.

In 1922—a short twenty-four years ago—there was no graduate course functioning actively in any dental school. One was organized that year and has been in continuous operation with gradually increasing classes ever since. Very soon a few other courses were offered, until now there are some eighteen university schools offering graduate and postgraduate courses of eight to fourteen months whole-time instruction. We are pleased to note that quite recently the University of Pennsylvania, Tufts, and the University of Montreal have added such courses.

In the case of the last mentioned, it is noteworthy that it is the first given in the Dominion of Canada. It is gratifying also to mention that the University of Toronto through its Dental Faculty will conduct a short, intensive course for orthodontists in January next. We understand that the class has been filled and regard it as a distinctive advance.

While we are pleased with the substantial increase in the number of courses offered because it stamps them as advocating graduate instruction in preparation for specialization in orthodontics, it also raises interest in the quality of instruction being offered. One of the Committee wrote me commenting on newly announced courses "that increases volume but not necessarily status. It seems to me that the one great thing needed in this country orthodontically is more schools which provide a high type of graduate instruction."

This expresses the unanimous opinion of your Committee on Education. There are at the present time hundreds of graduates in dentistry eagerly seeking admission to classes, and less than one-tenth can be provided for. This has a bad reaction, especially among returning veterans. Some are taking to the short proprietary and commercial courses—and may we note with genuine satisfaction that four such schools, clinics, etc., that once flourished in New York have been discontinued during the past two years, with only one remaining active. The demand is so great that it urges the question as to how the American Association of Orthodontists can be of help.

Your Committee suggests that the Board empower the Committee on Education to make a survey of existing courses and prepare recommendations for a minimum curriculum in the fundamental sciences and clinical training which, if approved by the Board, be offered to the American Association of Dental Schools and to the member schools of that Association. It would seem that this Association should be actively concerned with this problem as an important contribution to the public welfare.

Respectfully submitted,

LEUMAN M. WAUGH, Chairman
GEORGE M. ANDERSON
WALTER T. MCFALL

Presented at the meeting of the American Association of Orthodontists, Sept. 30-Oct. 3, 1946.

REPORT OF THE INTERRELATIONS COMMITTEE

MR. PRESIDENT AND MEMBERS OF THE BOARD OF DIRECTORS:

As the members of your committee view the present position of our speciality on this continent, we are conscious of the tremendous strides made in orthodontics; but at the same time we are mindful of the great difficulties facing our confreres in some countries where, because of the ravages of war, there has been retrogression instead of progress in our specialty. In the face of the world conditions which have prevailed during the past six years, any report of your interrelations committee at this time could hardly be expected to contain a review of accomplishments, but, in the resolutions which are appended, the ideas which we wish to bring forward for consideration are embodied.

In many of the devastated countries, the libraries of scientific literature have been completely destroyed and will be re-established only after years of patient and painstaking effort on the part of the members of the professions in those countries. The cooperation of the members of the American Association of Orthodontists in providing the nucleus of dental literature for such libraries would be a valuable contribution toward their rebuilding and would be a token of the interest and encouragement of the members of our profession to our confreres in those countries.

From the disquieting news which comes from the diplomatic front as we gather for this first postwar convention, it is evident that other agencies must be continually active for the attainment of world peace. The gathering together in convention of representative professional men, upon a basis of friendship and understanding, constitutes an important agency for the promotion of peace. The 1942 Inter-American Orthodontic Congress is an indication of the value of such professional conferences. The stimulus to orthodontics in the countries represented at that congress has been considerable.

An indication of willingness to cooperate in the newly formed World Health Organization, the constitution of which has already been approved by the legislative assemblies of some countries, by organized dentistry in America would be a further indication of our interest in the advancement of dentistry throughout the world.

The following recommendations are submitted for your consideration:

1. That in order to assist in the re-establishment of dental libraries in devastated countries, the Board of Directors authorize a canvass of the members of the American Association of Orthodontists by your committee, for contributions of dental and orthodontic books and journals to be forwarded to a central agency in the United States for distribution to officers of recognized dental societies in those countries, and that the sum of $100.00 be placed in the 1946-1947 budget for this purpose.

2. That as a means of stimulating orthodontic science and practice internationally the Board of Directors give consideration to the advisability of the organization of an international orthodontic congress at a suitable time and place.

3. That the Board of Directors recommend to the House of Delegates that the American Dental Association offer to cooperate with the newly created World Health Organization in matters pertaining to dental health.

GEORGE M. ANDERSON, Chairman
JOHN ROSS
G. VERNON FISK

Presented at the meeting of the American Association of Orthodontists, Sept. 30-Oct. 3, 1946.

Editorial

The New York Society of Orthodontists Changed to the Northeastern Society of Orthodontists

AT A recent meeting of the New York Society of Orthodontists, the name of the Society was formally changed, and it will hereafter be known as the Northeastern Society of Orthodontists.

Membership ranges over a wide area from Canada to the District of Columbia. It is thought, therefore, by the members of the New York Society, that the name Northeastern is now more fitting and appropriate for the organization.

It is to be recalled that all other organizations which make up the component parts of the American Association of Orthodontists have taken names that are descriptive of their districts. For instance, Rocky Mountain, Pacific Coast, Southwestern, Southern, Great Lakes, and Central describe the exact area in which the membership reside. It is no doubt a constructive change that has been made as it will place this society in conformity in this respect with all the others. The change was brought about by the unanimous vote of the organization and was suggested in deference to the states and districts that the society covers.

H. C. P.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Influences on Dental Defects in Naval Personnel: By C. A. Schlack, Commander (DC), USN, and J. E. Birren, Lieutenant, H(S), USNR, Naval Medical Research Institute, Bethesda, Maryland, *Science* **104**: 259-263, 1946.

Recruiting and induction of large numbers of men into the military services has resulted in the accumulation of considerable information on the educational and medical status of the American people. Frequently, personnel drawn from the various regions of the country display marked differences. It is the purpose of this paper to present certain important regional differences in the dental status of men entering the Navy and to relate these differences to some simple sociologic data.

Duplicate dental records of 69,584 men who were coming on active duty in the Navy in 1941-1942 were coded and transferred to punch cards through the cooperative efforts of the Research Division, Bureau of Medicine and Surgery, Naval Dental School, and the Vital Statistics Division of the Bureau of Medicine and Surgery. These data were then sorted by the latter Division into the distribution of dental defects (a) in the entire sample, (b) by region of birth, and (c) by age groups.

SAMPLE OF PERSONNEL

The men comprising this sample were principally white enlisted volunteers, although a few men on fleet reserve status who were called to active duty were also included. Upon entering "boot camp" for training they were given a dental examination which supplied the data for this paper. Before reaching "boot camp," however, some men were eliminated at local recruiting boards for dental defects. At the time the present sample of men entered the service, about 7 per cent had been eliminated for dental reasons in accordance with the dental standards of the service at that time. These applied to all regions, although it is probable that more men were screened out in some regions than in others. The effect of this screening is to decrease regional differences slightly, so it may be that, in the population at large, greater regional differences may exist than those noted here.

The mean age of this group of men was 24 years, and about 82 per cent of the men were below 30 years of age; these data are very close to the age distribution of all enlisted men in the service at that time.

The mean number of simple and compound cavities was found to be about 10 per person, which is in striking contrast to the 5 fillings found per person. This means, in effect, that the "average man" required more dental attention upon entering the service than he had received up to that time. A similar finding has already been reported by the Public Health Service for children. It thus appears that, in any large portion of the population of this country, the amount of dental attention required is far in excess of that already rendered.

The ratio of dental treatment required, to dental treatment already rendered, can be used as an index of dental attention, which, as will be shown later, varies considerably throughout the country.

Almost twice as much time was required to treat the men at the time they entered the service as they had received in the entire period preceding the examination. It should be mentioned here that the estimated dentist years of work is based on a complete year, including holidays, leave, administrative duties, and other nonclinical functions, and thus represents the total work placed in a year, not the length of time it takes to perform a specific task.

Emphasis has been placed so far on the number of cavities and fillings per person, because these represent the greatest source of dental treatment in the age group studies; with increasing age, more dentures would be required. Somewhat surprising is the fact that few teeth required extraction despite the large number of carious teeth, the mean number per person being about 0.2. In contrast, the mean number of missing teeth was 4.7 at the time of examination.

In general, New England and the Middle Atlantic region had the greatest number of defects per person, the East-South-Central and West-South-Central regions having the least number. Differences also appear in the number of fillings or restorations already placed. In fact, the regional differences are greater for fillings already placed than for the number of cavities present at the time of examination. Thus, New England, which had 64 per cent more cavities per person than the West-South-Central region, had 191 per cent more fillings per person. If number of cavities is added to the number of fillings per person to obtain the mean number of carious areas, it is found that New England tends to have about twice as many carious areas per person as the West-South-Central region, i.e., 21.3 vs. 10.9, respectively. This leads to the conclusion that New England has a much greater tendency to caries than the West-South-Central region, but in the former region a greater percentage of carious areas are filled.

It also appears that dental attention is not simply distributed according to regional needs. When the estimated time required to treat personnel from the various regions is divided by the estimated time already spent in treatment, an index of dental attention is defined which shows considerable variability among the regions. Thus, the Pacific Coast region had an index of 1.36, which means that personnel from this region required 1.36 times more dental work upon entering service than they had had up to that time. Personnel from the East-South-Central region, on the other hand, had an index of 3.22. It is apparent that many of the regions which have the best teeth inherently have unusually little dental attention. This large amount of variability suggests that some rather strong sociologic forces must be operating within the country that result in a disproportionate concentration of dentists in some regions.

In the Pacific Coast region, which had the most favorable dental attention index, there were 1,290 persons per dentist in 1940; the same region had a mean per capita income of $924. The region with the poorest dental attention index, the East-South-Central region, had 4,780 persons per dentist and a mean income of $361. When the nine regions are ranked in order from high to low for mean income, dental attention index, and number of persons per dentist, an almost perfect relation is described between these factors. One is led to conclude, therefore, that the dentists in this country are distributed according to the relative wealth of the regions, with the result that availability of dental attention is a function of regional wealth.

The West-South-Central region appears as a paradox on first analysis. This has next to the largest number of persons per dentist and next to lowest mean income per capita, with the result that it has next to the poorest dental

index. Despite this, however, personnel from this region have inherently the best teeth in the country when the total number of cavities are added to the total number of fillings already placed. From this, one may infer that the presence of dentists in a region has but slight effect on the dental status of persons from that region, and whatever the natural causes operating in the various regions, they seem more important than the number of practicing dentists. This is seemingly substantiated in the New England region, which has inherently the poorest teeth of all regions and almost twice as many dentists per capita as the West-South-Central region.

The total number of dentists in 1940 was 70,415, which yields a national ratio of 1 dentist per 1,870 persons. This is much lower than the ratio adopted by the Navy of 1 dental officer per 500 personnel. The scarcity is accentuated by the fact that it is questionable whether even the latter ratio is adequate to take care of all the dental defects in a group of that size. If we assume that 1 dentist per 500 persons is a reasonable ratio, then it is possible to estimate the number of dentists necessary in the entire country. Dividing the population of the nation by 500 yields a figure of 263,338 dentists, of which we now have 70,415, or about 27 per cent of those required. This estimate is only a very loose approximation, since the Navy deals only with an adult population and a select group. The qualifications that must be introduced by the inclusion of children and people with severe dental defects who would be rejected for military service are uncertain, and thus the estimate is most tentative.

The effect of age on the incidence of dental defects might hold considerable significance for the military services, if only from the practical view of how much dental care would be required. When the present data were examined for the purpose of evaluating age differences, few, if any, marked changes were manifest in the age groups under consideration. This could be interpreted as further substantiation of the view that most dental destruction or disposition to destruction occurs in childhood. When the men were divided into age groups, the youngest group (17-19 years) appeared to require as much dental care upon entering the service as any age group up to 40. From a practical dental standpoint, therefore, there appears to be no reason for setting a low age limit upon recruits for the services, since about as much time will have to be spent in dental repair at all age levels below 40. As might be expected, the older groups tend to have more dental restorations placed before entering service.

If existing dentists were distributed on a simple per capita basis throughout the country, personnel drawn from the southern regions would require considerably less dental care upon entering military service than those from other regions. A more equitable distribution of dentists would appear to be on the basis of regional dental needs. Thus, the number of dentists in New England, which totaled 5,038 in 1940, would drop to 4,512 if the existing dentists at that time were distributed on a simple per capita basis. With dental needs as the criterion, the redistribution of dentists would cause a rise to 6,058. This consideration does not in any way indicate the number of dentists actually required in New England if adequate dental care were available on the level accepted by the military services. Had adequate civilian care been available throughout the country in the years before the war, fewer dentists would have been required by the services. The number of dentists required in the services is thus not so much a reflection of unusually high standards, as it is a reflection of the lack of dental attention in the civilian population.

In conclusion, the study of naval personnel has shown not only that civilian dental care is not sufficiently available but also that the existing dental care is not distributed where it is most needed. The necessity for directing attention to caries prevention as well as to the repair of damage caused by caries has become obvious.

News and Notes

American Board of Orthodontics

The American Board of Orthodontics wishes to announce that at its meeting held in Colorado Springs, Sept. 26–Oct. 1, 1946, certificates were granted to thirteen orthodontists.

The Board also wishes to announce that the fee for application for examination was raised from $50 to $100.

The next meeting of the Board will be held immediately prior to the next meeting of the American Association of Orthodontists. For information relative to the Board, address communications to the secretary. Dr. Bernard G. deVries, Secretary, 705 Medical Arts Building, Minneapolis 2, Minn.

Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will hold its twenty-sixth annual meeting, Feb. 2, 3, 4, and 5, 1947, at Hotel Adolphus, Dallas, Texas. All members of the American Association of Orthodontists are cordially invited. Nonmembers must be properly certified. James O. Bailey, Secretary, Hamilton Building, Wichita Falls, Texas.

Pacific Coast Society of Orthodontists

The Pacific Coast Society of Orthodontists will hold its next general meeting in San Francisco, California, Feb. 24, 25, and 26, 1947.

J. Camp Dean, 1624 Franklin Building, Oakland, Calif., President.

Northeastern Society of Orthodontists

The next meeting of the Northeastern Society of Orthodontists (formerly New York Society of Orthodontists) will be held at the Waldorf-Astoria Hotel, New York, on Monday and Tuesday, March 10 and 11, 1947.

Central Section, American Association of Orthodontists

The Central Section of the American Association of Orthodontists will hold a scientific session at the Radisson Hotel, Minneapolis, Minnesota, April 14 and 15, 1947. There will be a registration fee of $10.00 for nonmembers of the Association.

District of Columbia Postgraduate Clinic

The District of Columbia Postgraduate Clinic (formerly the Five-State Postgraduate Clinic) will be held March 10, 11, 12, and 13, 1947, at the Statler Hotel, Washington, D. C., with Dr. James J. Greeves as general chairman.

Action Taken by American Dental Association House of Delegates Regarding the National Committee of Dentists, Oct. 16, 1946

Recently, the Central Office of the American Dental Association has received a number of inquiries concerning the action taken by the House of Delegates regarding the National Committee of Dentists.

This action, which was reported on page 1,499 of the November, 1946, midmonthly issue of *The Journal of the American Dental Association*, is as follows:

"That the National Committee of Dentists be commended in its efforts up to the present time."

In its Bulletin No. 3, issued Nov. 15, 1946, the National Committee of Dentists reported that the House of Delegates adopted the following resolution:

"WHEREAS, The members of this House of Delegates in official session at this 87th annual meeting as well as dentists throughout the United States are cognizant of the increasingly effective work of the National Committee of Dentists cooperating with the National Physicians Committee in familiarizing the public with the values, methods, and achievements of American dentistry, therefore,

"BE IT RESOLVED That the House of Delegates commends the National Committee of Dentists cooperating with the National Physicians Committee for the effectiveness of its efforts in preserving the private practice system and the American way of life.

"With over 400 in attendance, there was only one vote cast in opposition."

In the interest of fact, it must be pointed out that there is a wide difference not only in the wording of the two resolutions, but in their implications. Members are advised that the wording of the recommendation as passed by the American Dental Association House of Delegates, Oct. 16, 1946, is as follows:

"That the National Committee of Dentists be commended in its efforts up to the present time."

Council on Dental Education of the American Dental Association

THIRD CONGRESS ON DENTAL EDUCATION AND LICENSURE, STEVENS HOTEL, CHICAGO, SATURDAY, FEB. 8, 1947 (SOUTH BALL ROOM)

Morning Session—9:30 A.M. to 12:30 P.M.

Presiding: J. Ben Robinson, Chairman of the Council on Dental Education

Greetings: Sterling V. Mead, President of the American Dental Association

Topic: Re-evaluation of the Dental Curriculum, John T. O'Rourke, Director of Postgraduate Studies, Tufts College Dental School

Discussion: Opened by Lloyd E. Blauch, Office of Education, Washington, D. C.

Topic: National Qualifying Examinations in the Professions, Harlan H. Horner, Secretary of the Council on Dental Education

Discussion: Opened by Gordon L. Teall, Secretary of the National Board of Dental Examiners

Topic: The Aptitude Testing Program:

From the standpoint of the Council,

Shailer A. Peterson, Director of Educational Measurements of the Council on Dental Education

From the standpoint of the dental schools,

Willard C. Fleming, President of the American Association of Dental Schools and Dean of the College of Dentistry, University of California

Discussion: Opened by Ralph W. Tyler, Chairman of the Department of Education and Chief Examiner, University of Chicago

Afternoon Session—2:30 P.M. to 5:30 P.M.

Presiding: T. M. Barlow, President of the American Association of Dental Examiners

Greetings: Harold Hillenbrand, Secretary of the American Dental Association

Topic: The Future of Specialties in Dentistry:

From the standpoint of the Council,

James R. Blayney, Director of the Zoller Memorial Dental Clinic, University of Chicago, and Chairman of the Council's committee on specialties in dentistry

From the standpoint of the specialists,

Harold J. Leonard, Professor of Dentistry (Periodontology), School of Dental and Oral Surgery, Faculty of Medicine, Columbia University, and Secretary-Treasurer of the Advisory Board for Dental Specialties

Discussion: Opened by Howard C. Miller, President of the American Board of Oral Surgery

Topic: Auxiliary Agencies in Dental Practice:

(a) The Dental Technician,

Walter H. Wright, Dean of the College of Dentistry, New York University

(b) The Dental Laboratory:

Carl O. Boucher, Professor of Prosthetic Dentistry, College of Dentistry, Ohio State University, and Secretary of the Prosthetic Dental Service Committee, American Dental Association

(c) The Dental Hygienist:

Frances Agnes Stoll, Chairman of the Committee on Education of the American Dental Hygienists' Association

(d) The Dental Assistant:

Katie McConnell, Chairman of the Certification Committee of the American Dental Assistants' Association

Discussion: Opened by Philip E. Blackerby, Dental Director, W. K. Kellogg Foundation

Closing Remarks: J. Ben Robinson

Third Congress Committee.—Robert W. McNulty (Chairman), Dean, Chicago College of Dental Surgery, School of Dentistry of Loyola University, Chicago, Ill. Wendell D. Postle, Dean, College of Dentistry, Ohio State University, Columbus, Ohio. Robert P. Thomas, Secretary, American Association of Dental Examiners, Louisville, Ky.

German Dentists Used Plastic for Permanent Fillings

A plastic substance, used by American dentists only as a base for dentures and for crowns and inlays, was successfully utilized by Germans as a permanent filling for caries during the war, Major General Norman T. Kirk, The Surgeon General, reported recently.

A study made by an officer of the Surgeon General's Office of German dental practices since the start of the war found little else of value to the dental profession in the United States. Some progress was made in the field of dental materials—largely because of the necessity of finding substitutes for unobtainable substances rather than developing superior products.

Stainless steel was used widely as a substitute for the superior but scarce gold and silver. No new plastics were found, although some known to the American dental profession were put to novel uses.

Acrylic resin, a material widely used in the United States as a base for false teeth, was developed by the Germans as a permanent filling for direct use in a quickly hardening plastic state in prepared cavities.

Development of this material was halted in Germany by destruction of the factory in 1943, but it already had been used experimentally at that time. Fillings inserted in 1943 were found in excellent condition in 1945.

Germany apparently had no authorized standards for dental materials and remedies, the study revealed.

Many preparations of very doubtful value, and some of no value at all, were widely advertised and used. Gum diseases were common among the German population and apparently few Germans ever had their teeth cleaned.

American Dental Association, Bureau of Public Relations

The Bureau of Public Relations of the American Dental Association has produced electrically transcribed radio programs. These so-called "West of the Wind" programs have been specifically designed for the twofold purpose of interesting children in good literature and encouraging them to take better care of their mouths. They may be sponsored by the dental society, or preferably by the dental society in cooperation with the board of education, board of health, or public library.

The attached script for the "Black Stallion" broadcast is a typical example of the high quality of the "West of the Wind" series. Excerpts from the following books form the basis of the transcriptions:

1. The Trumpeter of Krakow
   by Eric P. Kelley
   The Macmillan Company
2. The Black Stallion
   by Walter Farley
   Random House
3. The Open Gate
   by Kate Seredy
   The Viking Press
4. Johnny Tremain
   by Esther Forbes
   Random House
5. Juneau the Sleigh Dog
   by West Lathrop
   Random House
6. On to Oregon
   by Honore Morrow
   William Morrow and Company
7. Storm Canvass
   by Armstrong Sperry
   John C. Winston Company
8. Thimble Summer
   by Elizabeth Enright
   Farrar & Rinehart
9. Snow Treasure
   by Marie McSwigan
   E. P. Dutton & Company
10. The Bears of Blue River
    by Charles Major
    The Macmillan Company
11. Hill Doctor
    by Hubert Skidmore
    Doubleday, Doran & Company
12. Lumberjack
    by Stephen W. Meader
    Harcourt, Brace & Company
13. The Dark Frigate
    by Charles Boardman Hawes
    Little, Brown & Company

Notes of Interest

Dr. Irving Grenadier wishes to announce the limiting of his practice exclusively to orthodontics, 888 Grand Concourse, Bronx 51, N. Y.

New Policy

The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY, at the expiration of present contracts, will conform to the ruling of the Council on Dental Therapeutics of the American Dental Association relative to journal advertising.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is composed of a representative of each one of the component societies of the American Association of Orthodontists.

American Association of Orthodontists

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President-Elect, Lowrie J. Porter - - - - - - - - - 41 East 57th St., New York, N. Y.
Vice-President, G. Vernon Fisk - - - - - - 818 Medical Arts Bldg., Toronto, Ont., Can.
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Northeastern Society of Orthodontists

President, Glenn H. Whitson - - - - - - - - - - 80 Hanson Pl., Brooklyn, N. Y.
Secretary-Treasurer, Oscar Jacobson - - - - - - - - 35 W. 81st St., New York, N. Y.

Pacific Coast Society of Orthodontists

President, J. Camp Dean - - - - - - - - - - - 1624 Franklin St., Oakland, Calif.
Secretary-Treasurer, Earl F. Lussier - - - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Henry F. Hoffman - - - - - - - - - 700 Majestic Bldg., Denver, Colo.
Secretary-Treasurer, George H. Siersma - - - - - - 1232 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, J. E. Brown - - - - - - - - - Merchants National Bank Bldg., Mobile, Ala.
Secretary-Treasurer, Leland T. Daniel - - - - - - 407-8 Exchange Bldg., Orlando, Fla.

Southwestern Society of Orthodontists

President, Brooks Bell - - - - - - - - - - - - Medical Arts Bldg., Dallas, Texas
Secretary-Treasurer, James O. Bailey - - - - - - Hamilton Bldg., Wichita Falls, Texas

American Board of Orthodontics

President, Oliver W. White - - - - - - - - 213 David Whitney Bldg., Detroit, Mich.
Vice-President, Joseph D. Eby - - - - - - - - - 121 E. 60th St., New York, N. Y.
Secretary, Bernard G. deVries - - - - - - - Medical Arts Bldg., Minneapolis, Minn.
Treasurer, James A. Burrill - - - - - - - - - 25 E. Washington St., Chicago, Ill.
James D. McCoy - - - - - - - - 3839 Wilshire Blvd., Los Angeles, Calif.
Stephen C. Hopkins - - - - - - - 1726 Eye St., N.W., Washington, D. C.
Reuben E. Olson - - - - - - - - - - 1115 River Blvd., Wichita, Kan.

A List of the Orthodontic Societies of the World and Their Principal Officers*

Chicago Association of Orthodontists

President, Richard A. Smith - - - - - - - - - - - - 636 Church St., Evanston, Ill.
Secretary-Treasurer, B. F. Dewel - - - - - - - - - 708 Church St., Evanston, Ill.

Harvard Society of Orthodontists

President, Henry C. Beebe - - - - - - - - - 358 Commonwealth Ave., Boston, Mass.
Vice-President, Sidney P. Stone - - - - - - - - 21 Columbia Rd., Dorchester, Mass.
Secretary-Treasurer, Harold J. Nice - - - - - - 475 Commonwealth Ave., Boston, Mass.

New York Society for the Study of Orthodontics

President, Myron Mage - - - - - - - - - - - - 225 W. 86th St., New York, N. Y.
Vice-President, Abbey E. Weinstein - - - - - - 25 Central Park West, New York, N. Y.
Secretary-Treasurer, H. Allen Bimston - - - - - 1882 Grand Concourse, New York, N. Y.

New York University Orthodontic Society

President, Robert J. DiTolla - - - - - - - - - - 5 E. 53rd St., New York, N. Y.
Secretary-Treasurer, Benjamin Ackerman - - - - - 7616 Bay Parkway, Brooklyn, N. Y.

Philadelphia Society of Orthodontists

President, Frederick R. Stathers - - - - - - - - 269 S. 19th St., Philadelphia, Pa.
Vice-President, William B. Jones - - - - - - - - 255 S. 17th St., Philadelphia, Pa.
Secretary-Treasurer, Augustus L. Wright - - - - - 255 S. 17th St., Philadelphia, Pa.

St. Louis Society of Orthodontists

President, Virgil A. Kimmey - - - - - - - - 3722 Washington Ave., St. Louis 8, Mo.
Vice-President, Leo M. Shanley - - - - - - - - 7800 Maryland Ave., Clayton 5, Mo.
Secretary-Treasurer, Everett W. Bedell - - - - - 1504 S. Grand Blvd., St. Louis 4, Mo.

Washington-Baltimore Society of Orthodontists

President, Daniel E. Shehan - - - - - - - - - Medical Arts Bldg., Baltimore, Md.
Secretary-Treasurer, William Kress - - - - - - - Medical Arts Bldg., Baltimore, Md.

Foreign Societies

British Society for the Study of Orthodontics

President, R. Cutler - - - - - - - - - - - - - 8 Lower Sloane St., S.W.1, London
Secretary, K. E. Pringle - - - - - - - - - - - - 12 Manchester Square, W.1, London
Treasurer, H. Chapman - - - - - - - - - - - - 6 Upper Wimpole St., W.1, London

Sociedad Argentina de Ortodoncia

President, Vicente A. Bertini - - - - - - - Constitucion 1239, San Fernando, F.C.C.A.
Secretary, Ludovico E. Kempter - - - - - - - - - Paraguay 577, Buenos Aires
Treasurer, Edmundo G. Locci - - - - - - - - - - Uruguay 763, Buenos Aires

*In the January issue of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is published each year a list of the orthodontic societies of the world of which the JOURNAL has any record, along with the names and addresses of their principal officers.

The JOURNAL keeps a file for each of these societies and publishes the names that appear in that file as of the date of going to press.

Sociedad Brasileira de Ortodoncia

President, Joaquim Cavalcanti - - - - - - - Praca G. Vargas 2, S. 422, Rio de Janeiro
Vice-President, Kant Duarte - - - Rua Manuel de Carvalho, 16-9°, S. 91, Rio de Janeiro
Secretary, Virgilio Moozen - - de Oliverira, Av. Rio Branco 311-6°, S. 613, Rio de Janeiro

Sociedad de Ortodoncia de Chile

President, Alejandro Manhood - - - - - - - - Avda. B. O'Higgins No. 878, Santiago
Vice-President, Arturo Toriello - - - - - - - - - - - Londres No. 63, Santiago
Secretary, Rafael Huneeus - - - - - - - - - - - - San Martin No. 133, Santiago
Treasurer, Pedro Gandulfo - - - - - - - - - - - - - Londres No. 63, Santiago

Sociedad Colombiana de Ortodoncia

President, José Mayoral - - - - - - - - - - - - - Carrera 9, No. 21-68, Bogota
Vice-President, Obdulio Mendez - - - - - - - - - - - Calle 12, No. 15-06, Bogota
Secretary-Treasurer, Marco Novoa - - - - - - - - - - Calle 11, No. 17-30, Bogota

Cuban Association of Orthodontists

President, Carlos Coro - - - - - - - - - - - - - - - - Virtudes 618, Habana
Vice-President, Dario Gandarias - - - - - - - - Calle 25, No. 954, Vedado, Habana
Secretary-Treasurer, Dra. Margarita Amézaga - - - - - - - - Virtudes 618, Habana

Guatemalan Association of Orthodontics and Relative Sciences

Secretary, Enrique Estrada H. - - - - - - - Apartado de Correos No. 110, Guatemala

Asociación Méxicana de Ortodoncia

President, Guillermo Gamboa - - - - - - - - - - - - Madero 34, Mexico City
Secretary, Rutilio Blanco - - - - - - - - - - - - - Donceles 98, Mexico City
Treasurer, Carlos M. Paz - - - - - - - - - - - - - Insurgentes 72, Mexico City

Sociedad Peruana de Ortodoncia

President, Augusto Taiman - - - - - - - - - - - - - - Arzobispo 284, Lima
Vice-President, Ricardo Salazar - - - - - - - - - - - - Edificio Olaya 38, Lima
Secretary, Carlos Elbers - - - - - - - - - - - - - - - Arzobispo 284, Lima
Treasurer, Gerardo Calderon -